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The Bar at the Mouth of the Mississippi River.

By D. S. Howard, Civ. & Marine Eng.

The vast importance of this impediment to the trade of one of the greatest commercial thoroughfares in the world, together with the other incalculable evils arising out of the freshets of this river alone, is well calculated to demand from an enlightened people a remedy, which may also be applied to numerous similar obstructions to navigation in other streams that have existed ever since the world began, and will ever exist until the subject shall have received the attention due to it.

There is no improvement within the reach of science of the same importance, that has so baffled the research of scientific men as that of rivers and harbors. Still, there is no reason to despair, for "necessity is the mother of invention," and we may look upon the bar at the mouth of the Mississippi, as a near relative to necessity, if not the real parent of some invention that will free the world, not only of bars at the mouths of rivers, but from various other obstructions above, as far as the current will admit of navigation without locks.

The invention, in fact, has already been made; but, in a republican government like ours, where a majority of the whole people have to sanction the policies adopted by the government, it is necessary that every subject of so much importance as this, should be thoroughly discussed before any great deviation can be made from the beaten track,

however unsuccessful we may hitherto have been in it. It, therefore, behooves us all to search among the established facts of the case for a true remedy.

If the remedy be found in any invention already made, let the arguments be put forth sustaining it by every advocate for the improvement of our country, the advancement of commerce, and justice to the bold originator of the plan, that it may be applied before the governments of Europe, or some power not dependent upon the people to sanction their policies, adopt the honor as well as the profit of a project so important to the world at large.

The newspapers are already bringing out Napoleon III. as the projector of "artificial lakes for the improvement of the Loire and other rivers of France," and, at the same time, say that "it has been suggested for the improvement of the Ohio," without mentioning the name of the man who suggested it.

We may here observe a prevailing disposition in human nature to make royalty the centre of greatness in the useful arts and sciences, as well as those of politics and war, by clothing it with the happy thoughts and suggestions of the more humble searchers after scientific truths. This would seem to be among the moral evils, but, if so, it is one out of which great good is often produced.

The weakest ruler knows enough of human nature to expect the clamorous applause of the weak and designing part of his people, for all the great designs he may be instrumental in carrying out, whether he be the originator of them or not; but that portion of mankind whose applause is of any value are ready to do justice to the real projector also. Many great projects are thus carried out through the influence of concentrated political power that might never have come to light by any other means, until the originators were beyond the reach of benefit from them.

Napoleon III., in adopting this plan, would manifest more discernment, more magnitude of purpose, and more ability to become great among a scientific people, than is common to heads of governments of any kind.

We have the facts and figures before us, from a source we have a right to respect as the best authority, countenanced by the highest scientific ability in that department of the nation, which show beyond a peradventure that one of the main tributaries of the Mississippi may be placed under perfect control by the expenditure of a small sum of money compared to the amount of property (saying nothing about the lives) lost at every great freshet. These figures also show that the perfect control over the freshets of the Ohio river, would have kept the waters within the levees on the lower Mississippi, through the two last great freshets, which would have saved enough to have made a good beginning towards improving all of the other principal tributaries, and securing the whole system of rivers against any serious damages from flood forever, besides the untold amount of benefit from the improvement of their navigation.

There is always good water over the bar at the mouth of the river

at any and all times when the river is confined within its banks. It is only when the freshets of the numerous tributaries act sufficiently in unison to cause an overflow of the levees, that the deposit at the mouth becomes troublesome. This fact, alone, shows conclusively that the whole evil is due to the additional amount of sediment produced by the freshets; and, though lateral outlets could be produced sufficient to relieve the levees and enable them to confine the remainder of the water, the navigation would still be obstructed. The only benefit of the lateral outlets would be the saving of swamp lands.

Another important fact is, that nature has provided better for the true remedy of *all* the evils arising out of the overflow of the Mississippi than of most other rivers. All who have explored its head waters bear testimony to it. The facilities for reservoirs are seldom surpassed. The country is filled with lakes and ponds.

The question has been raised (and strange to say by professed engineers, who, however, are opposed to the reservoir system,) against the usefulness of reservoirs without the expense of constant attendance to regulate them. It is true that a limited number may be made more useful if attended to and drawn off at proper times, but common observation might teach us the usefulness of reservoirs without attendance, by comparing such rivers as have natural reservoirs with those that have not, as the upper Mississippi with the upper Missouri. The one heads in numerous rice-lakes and swamps, and the other in the narrow valleys of the Rocky Mountains. The one is a gentle, pure, crystal stream until joined by some of its turbulent tributaries, and the other is a wild, furious stream, subject to be influenced by every rain or season of melting snow, causing freshets that change the current of the stream and wash away the banks, tearing up trees, and furnishing materials for bars, rafts, snags, and sawyers; and, when acting in concert with other similar streams in the same great basin, produce the great freshets that overflow the levees on the lower Mississippi, causing great destruction of property, enough at every such freshet, if properly applied, to establish the fact at least, that the reservoir system is the only true system for the improvement of rivers.

We may also compare the magnificent St. Lawrence with any other river of the opposite character; there is not one of the three hundred thousand square miles of this great basin that would not warrant cultivation so far as the climate is concerned. There are no parched deserts or inundated swamp lands to reclaim. Although there are many turbulent little streams among the head waters of this noble river, the natural reservoirs are so extensive and their surfaces bear such a proportion to the width of their outlets, that any rush of water from any combination of causes, is swallowed up without causing any sudden rise in the river below.

It is wholly unnecessary to include in estimates of the reservoir system a large item of expense for attendance after the reservoirs are built if the work be properly and permanently done. The outlets of each reservoir should have a width proportional to the amount of water to be discharged, and the height of the dam, which should never be

overflowed; then, the greater the proportion which the area of the surface of the reservoir bears to that of the water-shed, the nearer perfect will be the regimen of the river below.

One of the beauties of the reservoir system is, that any amount of money, however small, if properly expended, creates an immediate corresponding permanent benefit, which is well calculated to encourage the completion of the system.

It is no part of my purpose here to set forth the numerous advantages of the reservoirs in a country where the streams below require them. We have only to turn the American mind from speculations of far less importance, by showing the possibility of complete success, at a moderate comparative cost.

It would seem to be an easy matter of calculation to determine the comparative cost of retaining the surplus waters of the Mississippi near its source in spacious reservoirs, and confining them by levees less than one mile apart, and over a thousand miles long, each.

Where natural reservoirs do not exist among the numerous tributaries to the Mississippi, it is not being over-trustful to rely upon a diversified country containing a million or more of square miles, the extent of the great water shed of this river, to afford facilities for reservoirs better than the bed of the lower part of the river, where there are no materials but mud and perishable timber afforded for structures which, when constructed, are not only liable to be worn away by the various freaks of the current at different stages of the flood, but are subject to destruction at any time by the numerous animals that burrow in the banks near the surface of the water.

The amount of dike required to keep the surplus waters of any river back, if built along the banks of the upper streams without regard to the best locations for reservoirs, would bear the same proportion to the levees inversely, as the land overflowed by the dikes, to the surface of the stream enclosed by the levees. This brings the subject fairly before us. To all who have had occasion to observe the features of rivers and river basins, it is conclusive, that in no case can it cost as much to retain the surplus waters of any river or that amount which overflows the banks, by reservoirs above, as by levees below. It is also evident that locations may be selected somewhere within the great basin of any principal stream, that will not only reduce the expense of dams and dikes, but lessen materially the land to be overflowed.

It is well known that the land along rivers which empty into the ocean is valuable in proportion to its proximity to the coast generally, both on account of the quality of the soil, and the convenience of getting its products to market. The climate is also different, in favor of the lower waters, unless where nature, in a seeming desire to give us a useful hint, has supplied the country at the source of some few streams, such as the Oswego river in New York, the river Trent in Canada, and some of the other principal tributaries to the St. Lawrence, which bear incontrovertible testimony to the correctness of the policy of sacrificing the land necessary at or near the source, for the benefit of that and other property nearer the mouth of a river.

From a careful consideration of the admitted facts of the case, it is evident that nothing short of the reservoir system will ever be perfectly satisfactory to the aggregate interest in the Mississippi river. In the meantime something must be done for the commercial interests immediately.

In February last, the New Orleans Chamber of Commerce reported that five millions and a half of dollars worth of property was held in check, at one time, by the bar at the mouth of the river. I am confident this is no exaggeration, as I counted sixty-seven three-masted vessels at anchor near the bar, inside and out, and aground on it, at the South-west Pass, on the morning of the twenty-fourth of the same month, the most of which were undoubtedly detained by the vast accumulation of sediment. The river was then overflowing its banks and levees at near the highest point ever reached.

The only means for immediate relief are dredging and scouring. Dredging was resorted to in 1839, by Capt. A. Talcott, one of the ablest engineers ever in the U. S. service, under very unfavorable circumstances; but, had he possessed the advantages of the improved machinery now in use, he would have been eminently successful, as he usually is in all of his undertakings, more especially in the improvement of rivers and harbors.

In a very able report to the Chamber of Commerce of New Orleans by A. J. Duncan, in February last, a plan of dredging and scraping is recommended, such as has been tried with some success, but it would seem that a more economical use of power might be made by raising the material and depositing it on each side of a three hundred feet channel, which could be done without lighters by improved machinery already tested: the cost of outfit would be no more than that for dredging and scraping, and the cost of working much less. By these means the current in the channel would be increased by the deposit on the side; while, with wings recommended by Mr. Duncan so constructed as to increase the current near the bottom, and a proper construction of the lower machinery of the dredge for stirring up the mud, as much would be carried off by the current as when the drag and scraper are used, with much less power, besides what is raised and deposited outside the three hundred feet.

The possibility of depositing the excavated material one hundred and fifty feet from where it is raised without lighters, might be questioned were it not that machines are now in operation in similar and less favorable material, which is readily discharged by a spout inclined less than an inch to the foot.

If it should be objectionable to make any deposit on the sides of the channel, a machine should be constructed capable of carrying within itself one hundred cubic yards or more, with the lower machinery calculated for stirring up the mud while excavating, which may be gauged to load itself while passing from deep water above to deep water below, where the load would be discharged and the dredge returned by means of a propeller screw, worked by the same power.

On this plan, it is estimated that with an outfit of $50,000 and an

expense of $175 per day of 24 hours, 8000 cubic yards could be removed daily from the bar and deposited in the Gulf, which would admit of a liberal allowance for contingencies, and bring the whole cost below $100,000 for removing 900,000 cubic yards within six months, the amount required from the South-west Pass and Pass-à-l'Outra; making twenty feet depth, with a width of three hundred feet in each channel.

Corpus Christi, Texas, June, 1859.

Steam Engineering in 1859.* *Steam Generation (Continued).*

(Continued from Vol. xxxviii, page 366.)

In our last number we referred briefly to the present efficiency of boilers used on land, and pointed out the wide margin still left for improvement; and as it is neither the intention nor object of these general observations to enter minutely into constructive details, we propose now, as briefly, to say a few words respecting the present efficiency of marine boilers.

When steam was first applied to the propulsion of ships, it was generated in large boilers with capacious internal flues, the pressure per sq. in. seldom exceeding 4 or 5 lbs. The advantages of this class of boilers are the ready access to all portions of the internal surface for cleaning, and their consequent durability, extending frequently to 8 and 10 years; their disadvantages are their weight, both of iron and water, and the great space they occupy in the ship. They have been, and still are, much used for tug-boats, and a few may be found in some of our largest first-class steamships.

To remedy the great weight and bulk of the flued boiler, the multitubular system was introduced, and it has now almost completely supplanted all other kinds of boilers for steamships, and although the particular arrangement of the present marine boiler may not be the best, it has nevertheless stood the test of a lengthened trial, and to a certain extent can be fully relied on.

To those practically acquainted with the construction of the boilers now in general use in our naval and merchant steam fleets, we shall be understood in describing them as those in which we have first the furnace, then the flame-box as a continuation thereof, then the tubes or flues returning over the furnace to the smoke-box; and, lastly, the uptake leading from the smoke-box to the chimney, and all, excepting the chimney, enclosed in the outer shell. This is the kind of boiler now generally adopted on board ship; in some cases, as in the *Great Eastern*, there are furnaces at each end of the boiler, leading into one flame-box, and having two sets of return tubes, leading to one or two chimneys as may be preferred. This arrangement, well proportioned, can be made the most effective of any, the only drawback being the necessity of having two stoke-holes—a matter of some importance in a small ship.

Adhering to the rule we have hitherto observed to avoid discussing exceptional cases, we will only allude in passing to the existence of two

*From the Lond. Artizan, July, 1859.

other kinds of boiler sometimes placed on board ship. In the one, we have, instead of return tubes, a series of vertical chambers, strongly stayed, and formed of ¼ in. plate. This arrangement has some advantages, one of which is stated to be that of durability. In the other design, introduced into several American mail steamships, the flame passes from the flame-box among a number of vertical tubes to the uptake, the steam being generated from the water in these tubes. We simply mention these exceptional arrangements, because they deserve to be noticed as having been proved by actual experience to be sound and practical.

We now return to the ordinary multitubular marine boiler as previously described, and generating steam generally at a pressure of from 15 to 25 lbs. per sq. in.; 30 lbs. per sq. in. appears to be the limit to which flat surfaces can be safely stayed, without crowding the stays so as to prevent easy access for cleaning and repair, and as also a rectangular form of shell wastes less space in the ship than a cylindrical, the former is almost universally adopted, and will, doubtless, be retained until the use of steam of higher pressure necessitates a different construction better calculated to resist the increased pressure.

The few accidents from explosion that have occurred in British steamships seem to show that as a general rule marine boilers have been constructed of sufficient strength for the pressure used, although this is no proof that the material has been well applied; indeed it is matter of congratulation that we are not at present called upon to criticise the constructive details of a very large portion of our present marine boilers. We must, however deprecate the common practice of attaching long stays intended to resist a strain of 3 tons to one side only of a single angle iron by a badly fitting bolt of 1¼ in. or 1½ in. diameter; as also the system adopted in many large works of plating boilers without reference to the position of the stays, as though they could be shifted any where to suit the seams.

In no branch of mechanical engineering has such a want of science and constructive ability been displayed as in the designing and construction of marine boilers; and at the present time the bulk of our locomotive boilers have the longitudinal joints of the barrels only singly riveted, although it is known that an additional row of rivets would increase the cost but slightly, add some 14 per cent. to the strength of the barrel, and enable the weight to be reduced. It is very questionable if a late explosion and consequent loss of life would have occurred if the system of double riveting had been adopted.

The very best engineering should be displayed in the mechanical design and construction of boilers; and if an ignorant class of men are employed as foremen, the drawings supplied to them should be of the most complete and precise description.

In investigating the working efficiency of the present multitubular marine boilers, we are met at starting by a difficulty not experienced in land boilers—we allude to the use of salt water, which not only causes a considerable waste of fuel, but renders it almost impossible to ascertain with any degree of accuracy the evaporating power of a boiler;

and this element of uncertainty as to the duty realized has exercised a most baneful influence on the improvement of marine boilers in the mass.

Our standard works, too, on the steam-engine have greatly underrated the loss of fuel occasioned by the use of salt water, and constantly discharging into the sea a portion of the heat created by combustion in the furnace. It has been assumed that the loss of fuel referred to may be estimated by calculating the heat required to raise the extra feed supplied (to be afterwards blown into the sea), from its entering temperature to that at which it is discharged from the boiler; but observation and experience prove that both water and *steam* are discharged; and hence there is not merely the loss of sensible heat, as before estimated, but also a considerable loss of that latent heat in the steam, previously generated at a considerable expense of fuel. If this is not so, how is the fact accounted for, that in America, as the result of considerable experience in both fresh and salt water boilers, it is found absolutely necessary to allow at least one-fourth more boiler power when salt water is used than when fresh, whilst many engineers allow even a difference of one-third?

We have then in ordinary practice, instead of a loss of some 10 or 12 per cent., as generally stated, a loss of at least 20 per cent.; and we have known instances where the loss of evaporative power, by changing from fresh to salt water, has amounted to 30 per cent.

If we are moderate, and take one-fifth as the actual loss, this alone is a serious drawback, when economy of fuel is of so much importance on board ship. There is without doubt considerable difference in the amount of loss by blowing out, according as the engineer in charge is more or less intelligent; for whilst on the one hand too much regard to economy may ruin the boiler, on the other, too much regard to avoidance of incrustation will result in needless waste of fuel.

We repeat, that in consequence of the inconvenience attending any attempts to ascertain the actual evaporation or economical efficiency of marine boilers, the most extreme views and practice have obtained, and almost without comment or criticism; no one knows with certainty the actual result of any particular arrangement or proportion, and consequently, no one has the means of giving a standard for comparision.

Among several thousand boilers now in use, we find the greatest variety of constructive proportions, and as a natural result there exists a difference of 30, 40, and 50 per cent. in the evaporative power of boilers having equal heating-surface and fire-grate.

The amount of heating-surface and fire-grate allowed for a given nominal power, varies 25 and 100 per cent. respectively, whilst the ratio between these two main elements varies fully 70 per cent. We are literally "at sea" in marine boiler engineering, nor do we seem to acknowledge practically that, except under special circumstances, there must be certain arrangements and proportions that will give the best result.

The first desideratum in all boilers is to obtain as perfect combustion of the fuel as possible, and experience has fully proved that, unless special arrangements are made for a supply of oxygen to the fuel, in

addition to what is passed through the fire-grate, by a natural draft, and unless ample space is allowed in the furnace and flame-box for the products of combustion to combine, and maintain a high central temperature, the total heat resulting from combustion will be far short of what can be realized.

Now these are not opinions, they are proved facts—obvious to every unprejudiced practical engineer; and it is, therefore, difficult to explain why so many boilers are designed with proportions entirely at variance with these ascertained facts.

Seldom are efficient arrangements made for the required supply of air, and the furnaces are so contracted in height that the fuel almost touches the upper plates; and then, as the half-consumed products of combustion struggle along this comparatively cold-walled chamber, they pass into a flame-box (often only 16 in.) as contracted as the furnace; and when they traverse the small tubes the wasteful operation is completed, and results in a deposit of soot, and a most defective evaporation. This state of things exists in the bulk of our present marine boilers, and is discreditable to the reputation of British engineers.

An impartial consideration of comparative results in burning fuel in a boiler furnace appears to indicate that there should be a minimum height of 2 ft. between the fire-bars and furnace-crown, at the dead-plate, and a minimum length of 2 ft. to 2 ft. 6 in. in the flame-box.

Without presuming to pass judgment on the comparative merits of the various schemes for furnishing an extra supply of air to the furnace, for the purpose of effecting a more perfect combustion, and the consmption of smoke, we cannot but feel it is due to Mr. C. W. Williams to express the opinion, that his simple arrangements deserve the best consideration and confidence of practical engineers.

The vexed question of what description of coal is best for marine boilers is yet undecided, although of late years careful experiments have, to a certain extent, disproved the results arrived at by the Admiralty, and given in their three Reports; and we may add, that the public estimation of the value of the best North Country coal, for steam purposes, is greatly increased; and enough has been done to convince the unbiassed that, with certain arrangements of furnace, external smoke can be almost entirely avoided.

In supplying furnaces with fuel, it is to be regretted that the practice is so common of throwing the fresh charge of fuel to the back of the furnace, instead of keeping the fresh fuel supplied to the front near the dead-plate, and, as combustion increases, pushing it towards the bridge. This latter system of firing, as well as others of a similar character, entails rather more work on the stoker, and hence is seldom adopted.

The arrangements generally introduced for the supply of air to the stoke-hole are of the most imperfect description, the cold air descending being met and obstructed by the hot air ascending, and this arrangement is adopted with the knowledge that the evaporative power of marine boilers is often seriously affected by a deficient supply of air to the stoke-hole.

If fault can be found with the present arrangements and proportions of furnace and flame-box, what shall be said of the varied dimensions of the return tubes? On the Thames we have $2\frac{1}{2}$, $2\frac{3}{4}$, and 3 in. tubes from 5 to $6\frac{1}{2}$ ft. long; on the Clyde we have from 3 to 4 in. tubes from 6 ft. to 8 ft. in length, and to estimate rightly the importance of these tubes, it must be remembered that they constitute about three-fourths of the total heating surface. Many a marine boiler has been spoilt by the introduction of badly-proportioned tubes. Then there is the question of what actual evaporative value a long tube has; from the results of some careful experiments it has been ascertained that about one-fifth of the length of the tube next the flame-box was equal in evaporative value to the flame-box itself, but that the remaining four-fifths were not together, equal in evaporative value to the one-fifth next the flame-box, and that the one-fifth next to the smoke-box was of very little use for generating steam.

Now, if these experiments are trustworthy, and we believe they are, they must modify considerably the prevailing opinions on the evaporative value of tube surface; and it may be conceded that practical experience with long small tubes has generally corroborated the conclusions to be drawn from them.

The practical difficulty that arises by the adoption of short tubes, is the necessity of increasing the number to obtain that heating surface which the ship-owner expects to receive from the manufacturing engineer, and which he is not inclined to lessen, although with the improved arrangement it may be more effective.

In considering the question of diameter and length of tubes, there are two points to be noticed: first, the sectional area through the tubes being sufficient to receive and convey the expanded gases from the furnace without retarding the same; and, secondly, reducing the length of tube to a minimum consistent with the heating surface required, and the number of tubes that can be conveniently introduced.

It is not our wish to lay down the law on a subject so full of difficulty, but we can safely indicate in what direction we have erred, and what course should be pursued to remedy those errors.

An imperfect and sluggish combustion is the inevitable result of contraction in the sectional area through the tubes, and a waste of fuel is as inevitable where there is a deficiency of heating surface for a given rate and amount of combustion.

Numerous cases occur in daily practice in which both the above errors are existing, and are simply the result of defective information in the designer.

It is not unusual to find a difference of 25 per cent. in the areas of the chimneys of boilers of the same size and proportions; considering that the heated products of combustion gradually cool and contract as they leave the tubes, and that the frictional surface is reduced from about 13 to 1, there can be no doubt that the sectional area of the funnel should be considerably less than that through the tubes; we find, however, frequent instances, where the chimney is as large, and even larger in sectional area than the tubes.

Then who decides on the height of the chimney? why, frequently even in large establishments the draughtsman who prepares the rigging plans, so as to make it look well with his spars, &c.; thus often a boiler that requires an unusually high chimney has a low one.

We have on a previous occasion referred to the connexion always existing between the generating power of a boiler and the difference of temperatures between the escaping gases and the water to be raised into steam; a strong draft and rapid combustion making an effective but not an economical boiler.

With a chimney of a given height—the draft being dependent upon the temperature of the escaping gases—when there is a large proportion of heating surface, a sharp natural draft and rapid combustion are not attainable.

As long as the rate of combustion is dependent upon heat escaping up the chimney, so long must the loss of that heat be submitted to; and if an artificial blast is substituted, and an attempt is made to absorb all the heat created by the combustion in the furnace, we shall still have this practical difficulty, that when the difference between the temperatures of the flues and water becomes, as it would in this case, very small, either a great increase of time must be given to complete the evaporation, or the ratio between the heating surface and the rate of combustion must be greatly increased.

The advantage to be derived from an artificial blast is the power to increase the rate of combustion *ad libitum*, and thus make a small boiler do the same duty as a large one; and, as a question of weight of boiler, such an arrangement is of great importance.

What are the practical deductions to be made from the preceding remarks?

We think there is sufficient evidence, of a thoroughly practical kind, to prove that attention to those arrangements and proportions we have shadowed forth, will result in a considerably increased duty and economy.

With capacious furnaces and flame-box, an ample supply of air both in the stoke-hole and fuel, tubes *not exceeding* 5 ft. in length, and not less than 3 in. external diameter, a ratio of heating surface to fire-grate of not less than 40 to 1, and a rate of combustion from 16 to 22 lbs. of good steam coal per sq. ft. of fire-grate, with such proportions 11 lbs. of water can be evaporated under atmospheric pressure by 1 lb. of coal.

When we compare such a result with the average duty realized at the present time, we feel we are justified in deprecating the present inefficient state of our marine boiler engineering, with its deficient supply of air, contracted furnaces and flame-box, badly proportioned tubes and chimney, and an evaporative duty of only some 7 to 8 lbs. of water by 1 lb. of coal.

Unless surface condensation is introduced there appears little prospect of any extensive introduction of high-pressure steam into steamships, and we must be content for some time yet with a maximum pressure of 30 lbs. per sq. in.

If surface condensation ever becomes general, we may be quite cer-

tain there will be a considerable increase of the working pressure; but to design a boiler adapted for a steamship and capable of resisting a working pressure of 100 lbs. per sq. in., requires great care and experience: either the cylindrical form must be adopted or flat surfaces must be stayed, like the fire-box of a locomotive boiler; in either case, it is impossible to allow of internal cleaning, so that any failure of the fresh water supply would be fatal to durability.

Although the block-ships and gun-boats fitted with high-pressure machinery, and working with salt water, are so seldom under steam, great inconvenience has resulted from the inability to keep the boilers free from incrustation.

If steam could be generated in small pipes, and their durability ensured, it would be a perfect high-pressure boiler, as 200 lbs. per sq. in. could be generated with as much safety as 20 lbs. in our present marine boilers.

We do not think there is any more hopeful branch of engineering than that connected with the propulsion of ships, nor any more likely to repay the improver. Necessity will ultimately oblige both steamship owners and engineers to economize fuel, and a truly satisfactory result can only be arrived at by the most laborious and persevering attention to the minutest details.

Connected with boiler engineering, the profession is much indebted to Mr. Fairbairn for data of a most valuable character; and there are many engineers of the present day who are helping to introduce great improvements. Our English exclusiveness militates greatly against a free interchange of practical experience among our leading engineers, and the young engineer must trust entirely to his own struggles for a position.

In the preceding remarks many points of interest in steam generation have been omitted, but with the excepting ordinary details, they will be referred to in the introductory observations on the Application of Steam as a Motive Power.

(To be Continued.)

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*On Experiments to Determine the Efficiency of Continuous and Self-acting Brakes for Railroad Trains.**

By William Fairbairn, C.E., F.R.S., &c.

[A paper read before the British Association, 1859.]

Of late years various improvements have been introduced upon railways, to diminish the dangers of traveling, and attention is now specially directed to the increase of the retarding power for trains by various kinds of brakes. From an early period in the history of railways, it was seen that few objects were more important for ensuring the security of passengers, and reducing the loss of time occasioned by stoppages, than the attainment of some means of destroying the momentum of trains with ease and rapidity: that is, in the least time and

*From the Lond. Mechanics' Magazine, October, 1859.

in the shortest distance. The less the time requisite to brake a train, the longer the steam may be kept on in approaching a station and the less is the loss of time in stopping. And the shorter the distance in which a train can be brought to a stand, the less danger is there of collision with obstructions on the line perceived not far off ahead. It is already allowed by many of those connected with railways, and has been expressly stated by the Lords of the Committee of Privy Council for Trade, that the amount of brake power habitually supplied to trains is in most cases insufficient, and their Lordships enumerate thirteen accidents from collision occurring in 1858, the character of which they consider would have been materially modified, if not altogether prevented, by an increased retarding power under the command of the guards of the trains.

Upon this subject the most important communication hitherto made has been the Report prepared by Colonel Yolland for the Railway Department of the Board of Trade, and containing a large number of experiments with heavy trains at high velocities. The brakes with which Colonel Yolland experimented were those which, as improvements on the common hand brake, have hitherto commanded most success. These were the steam brake of Mr. McConnel, the continuous brake of Mr. Fay, the continuous and self-acting brake of Mr. Newall, and the self-acting buffer brake of M. Guerin. The general conclusions to which Colonel Yolland was led by his experiments resulted in the recommendation of the brake of Mr. Newall; and for heavy traffic, a provisional recommendation of the brake of M. Guerin.

From a misunderstanding caused by this Report of Colonel Yolland arose the necessity for some further experiments on the similar brakes of Mr. Fay and Mr. Newall; and these I was called upon to arrange and carry out, by the directors of the Lancashire and Yorkshire Railway. I propose to lay before the Association a brief abstract of these experiments, with some remarks upon the conclusions to which they gave rise.

It will not be necessary here to describe minutely the details of the construction of these brakes. They consist essentially of a series of brake blocks acting upon every wheel of the carriages of the whole train or some part of the train, the brake blocks being suspended as flaps or placed on side bars beneath each carriage, as in the ordinary arrangement of the guard vans. But whereas it would be both expensive and inefficient to work these brakes with a guard or brakesman to each carriage, both Mr. Fay's and Mr. Newall's patents provide for a continuous shaft, carried the whole length of the train beneath the framing, and with suitable jointed couplings between each pair of carriages, so that they may be undisturbed by the rocking motion of the train or the action of the buffers. In this way the whole of the brakes may be worked by a single person at either end of the train communicating his power to each brake through the agency of the continuous shaft.

Again, there have been applied, in the first instance by Mr. Newall and subsequently by Mr. Fay, powerful springs beneath each carriage, connected with the arms of the rocking shaft, by means of which the

brakes are made to act instantaneously throughout the train, on the release of a catch or disengaging coupling in the guard's van. The value of this provision for the immediate and simultaneous action of the whole of the brakes, in cases where an obstruction is perceived upon the line, will be at once evident. It is one of the most important features of these brakes.

In carrying out the views of the directors of the Lancashire and Yorkshire Railway Company, it was arranged, in order to test the relative efficiency of these brakes, to have a series of experiments upon the Oldham incline of 1 in 27 on this gradient. A train of carriages fitted with Mr. Newall's self-acting slide brakes, and a similar train fitted with Mr. Fay's continuous flap brakes, were started in turn, and after having passed over a measured distance by the action of their own gravity, the brakes were applied, and the distance along the incline in which the trains were respectively brought up was carefully ascertained, as a measure of the retarding force of each. The trains employed consisted of three weighted carriages each, and having been placed upon the incline, they were started by removing a stop. Having then descended a previously measured distance with a uniformly accelerating velocity, they passed over a detonating signal, which conveyed notice to the guard to put on the brakes. Then the train having been brought to a stand, the distance from the fog signal to the point at which the train stopped was measured, and the train brought back for another experiment. In this way it was easy to obtain an initial velocity of 50 ft. a second, or 35 miles, before applying the brakes.

Unfortunately, the day upon which these experiments were made proved misty and foggy, with rain at intervals, so that the rails were in the very worst condition for facilitating the stoppage of the train. The significance of this fact will be seen on comparing the retarding power of the brakes in these experiments with those made in fine weather.

Reducing the results, we find that the retarding force exerted by each brake in terms of a unit of mass, was equivalent to the numbers in the following table:—

EXPERIMENTS ON THE OLDHAM INCLINE.

No. of experiment.	Mr. Newall.			Mr. Fay.		
	Velocity of train in feet per second.	Time in stopping in seconds.	Retarding force of brake.	Velocity of train in ft. per second.	Time in stopping in seconds.	Retarding force of brake.
1	25·71	14	1·32	25·71	13	1·91
2	30·00	16	1·63	30·00	13	1·79
3	37·50	17	1·70	37·50	14	1·84
4	42·85	25	1·69	41·37	15	1·76
5	42·85	14	2·01	40·66	12	2·02
6	48·38	19	1·78	48·38	25	1·72
7	52·94	17	2·04	50·00	17	1·91
	Mean.	21·6	1·74	Mean.	19·2	1·85

The general result of these experiments gives a retarding force of 1·74 lbs. per unit of mass for Mr. Newall's brake, and 1·85 for Mr.

Fay's. Or, in other words, Mr. Newall's brake exerted a retarding force of 121·3 lbs. per ton weight of the train, and Mr. Fay's a retarding force of 129 lbs. per ton.

I afterwards arranged for some further experiments at Southport upon a piece of level rail between that town and Liverpool. The speed requisite in this case had to be obtained by the aid of an engine, which was detached by a slip coupling at the instant of applying the brakes. In other respects these experiments were conducted like the preceding, with fog-signals, and the time noted by stop watches. The weather, however, was in this case fine and dry, and hence the following results were obtained in the most uniform circumstances.

The friction of the train itself, and the resistance of the air, was ascertained to amount with Mr. Newall's train to 6·4 lbs. per ton, and with Mr. Fay's train to 10·4 lbs. per ton.

EXPERIMENTS AT SOUTHPORT.

Slide brakes; Engine detached.

Mr. Newall.			Mr. Fay.		
Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of brake.	Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of brake.
32·72	56⅔	6·77	35·29	56	7·97
36·73	77	6·28	43·90	98	7·05
43·90	136	5·08	50·00	129	6·94
46·15	140⅔	5·42	54·54	144	7·40
52·94	205⅓	4·89	54·54	161⅔	6·59
54·54	192	4·66	37·89	97	5·30
47·37	260⅓		60·00	204⅔	6·30
53·73	222	5·23	60·00	214	6·03
63·16	273	5·55			
Mean.		5·49	Mean.		6·70

In this case we have a retarding force per unit of mass equivalent to 5·49 lbs. in Mr. Newall's brake and 6·7 lbs. in Mr. Fay's. Or, in other words, the retarding force of the slide brakes of Mr. Newall, from eight experiments, at velocities varying from 35 to 60 miles an hour, was equivalent to 382·6 lbs. per ton weight of the train. The retarding force of Mr. Fay's slide brake, from eight similar experiments, at velocities from 33 to 63 miles per hour, was equivalent to 466·4 lbs. per ton weight of the train.

FLAP BRAKES—ENGINE DETACHED.

Mr. Newall.			Mr. Fay.		
Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of brake.	Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of brake.
50·00	132⅔	6·75	51·43	158½	5·98
50·00	123	7·28	51·43	162¾	5·82
51·43	192	4·93	54·54	184	5·79
Mean,		6·32	Mean,		5·87

These experiments give for the retarding force of Mr. Newall's flap brake 6·32 lbs. per unit of mass, and for Mr. Fay's, 5·87 lbs.

Or, in other words, the retarding force of Mr. Newall's flap brake, from three experiments at velocities varying from 50 to 51½ miles per hour, was equivalent to 440·3 lbs. per ton weight of the train.

The retarding force of Mr. Fay's flap brakes, from three similar experiments, was 408·6 lbs. per ton.

We may illustrate the general bearing of these experiments by estimating from an average of the whole experiments the distance required to stop a train fitted with these brakes, and detached from the engine:—A train would be stopped at a velocity of

20	miles an hour in	23·4 yards.
30	" "	52·9 "
40	" "	93·8 "
50	" "	146·8 "
60	" "	211·5 "

This last table exhibits, in a very clear manner, the advantages of this class of brakes, in which the whole weight of the train aids in destroying the momentum of the mass instead of the weight of one or two guard vans only. It may be impossible in long trains to apply these brakes to every carriage; but at all events, in the ordinary traffic, three times the present amount of brake power may be employed with ease.

On the score of economy, also, the system appears to encourage its application. From experiments which have been made, it appears that the wear of the tyres is far more uniform and equal, because the springs may be so adjusted as not to cause the wheels to skid. The manager of the East Lancashire Railway states that with two trains running together between Salford and Colne, the carriages fitted with continuous brakes traveled 47,604 miles before the wheels required turning up; whilst an ordinary brake van, running the same distance, had to have its wheels turned up three times in the same period, three-eighths of an inch being taken off each time.

EXPERIMENTS AT SOUTHPORT.

Engine not detached from the trains.

Mr. Newall.		Mr. Fay.		
Speed per hour.	Distance of pulling up.	Speed per hour.	Distance of pulling up.	Remarks.
Miles.	Yards.	Miles.	Yards.	
33·96	124⅔	31·8	121⅔	
37·11	169½	33·96	137	} Engine and tender.
41·86	221	41·86	192½	} Tender brake applied.
		51·43	274	Tank engine.

It will be observed that on most through lines the trains travel on some portion of the distance at the rate of 60 miles an hour; and in the event of an obstruction half-a-mile in advance a collision would be inevitable unless the driver has the power and the presence of mind to act with promptitude. Now, at 60 miles an hour there is only 30 seconds, or half-a-minute, to effect that object, and it is quite impos-

sible to apply the brakes in their present state before the train—in such a precarious position—is in actual contact. Assuming, however, that brakes upon the principle of Newall and Fay were attached to the engine as well as the train, and that the driver had the power of instantaneous application, by liberating a spring, it is evident that instead of the train dashing forward to destruction, the momentum might be destroyed in a distance of less than 500 yards, and that without injury to life or property. Besides, the application of the electric telegraph, which prevents on most through lines more than one train being on the line between the stations, is a great additional security, and that united to the continuous brake *applied to the engine as well as the train* would, when united to a more perfect system of signals, render collision next to impossible.

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*Experimental Researches to Determine the Density of Steam at all Temperatures.** By W. Fairbairn, F.R.S., & T. Tate, F.R.A.S.

[Proceedings of the British Association, 1859.]

I propose to give a short sketch of an apparatus, and the results of the earlier experiments which, in conjunction with my friend Mr. Thomas Tate, I have been investigating by direct experiments, with the intention of determining the law of the density of steam and other condensible vapors; and thus to solve a hitherto almost untouched problem by an experimental method, which will verify or correct the theoretical speculations in regard to the relation between the specific volume and temperature of steam and other vapors. The experiments are being conducted, it is believed, upon an entirely novel and original principle, and one which is applicable at any temperature and pressure capable of being sustained by glass vessels.

For a perfect gas, the law which regulates the relation between temperature and volume is known as Gay-Lussac's or Dalton's law, and is expressed by the equation:—

$$\frac{V \times P}{V_1 \times P_1} = \frac{458 + t_1}{458 + t} \quad . \quad . \quad (1).$$

Now, density of steam has been determined with accuracy by direct experiment at the temperature of 212°—and at that temperature only by the method of Dumas. At 212° Fahrenheit its density is such that its volume is 1670 times that of the water which produced it.—Hence, assuming Dalton's law to hold for steam, and substituting these values of volume, temperature, and pressure, we get for the volume of steam from a unit of water at any other temperature:—

$$V = \frac{1670 \times 15}{670} \times \frac{458 + t}{P}, \text{ Or, } V = 36\tfrac{1}{3} \frac{458 + t}{P}, \qquad (2).$$

These are the well-known and received formulæ from which all the tables of the density of steam have hitherto been deduced, and on which calculations on the duty of the steam-engines have been founded. Up to the present time, however, this formula has never been verified by

* From the Lond. Mechanics' Magazine, Oct, 1859.

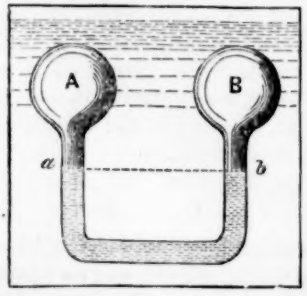
direct experiment, nor are the methods hitherto employed in determining the density of gases and vapors applicable in this case, except at the boiling temperature of the liquid at the ordinary atmospheric pressure. But, on the other hand, theoretical speculations throw considerable doubt on the accuracy of the above formula when applied to steam and other condensible vapors. Several years ago, Dr. Joule and Professor William Thomson announced, as the result of applying the new dynamical theory of heat to the law of Carnot, that for temperatures above 212° Fahrenheit, there is a very considerable deviation from the gaseous laws in the case of steam. Later, in 1855, Professor Macquorn Rankine has given a new theoretical formula for the density of steam, independent of Gay-Lussac's law, and confirmatory of Professor Thomson's surmise. But as yet these speculations need the evidence and verification of direct experiment.

The density of steam is ascertained by vaporizing a known weight of water in a glass globe of known capacity, and noting the exact temperature at which the whole of the water becomes converted into steam. From these three elements,—volume, weight, and temperature—the specific gravity is known. But in pursuing this method, these two difficulties must be overcome. First, the pressure of the steam renders it necessary that the glass globe should be heated in a strong and consequently opaque vessel. Second, as steam rapidly expands in volume for any increase of temperature beyond the temperature of saturation, it would, in any case, be impossible to decide by the eye the temperature at which the whole of the water became vaporized. The temperature of saturation, or temperature at which the whole of the moisture is converted into steam, whilst no part of the steam is superheated, must be determined with the utmost accuracy, or the results are of no value.

The difficulties thus resolve themselves into finding some other test of sufficient accuracy and delicacy to determine the point of saturation. This has been overcome by what may be termed the saturation gauge; and it is in this that the novelty of the present experiments consists.

To illustrate the principles of the saturation gauge, suppose two globes A and B, Fig. 1 connected by a bent tube containing mercury at *a b*, and placed in a bath in which they can be raised to any required temperature. Suppose a Torricellian vacuum to have been created in each globe, and twenty grains of water to have been added to *a*, and thirty or forty grains to B. Now, suppose temperature to be slowly and uniformly raised around these globes; the water in each will go on evaporating at each temperature, being filled with steam of a density corresponding to that temperature, and the density being greater as the temperature increases.—At last a point will be reached at which the whole of the water in globe *a* will be converted into steam, and

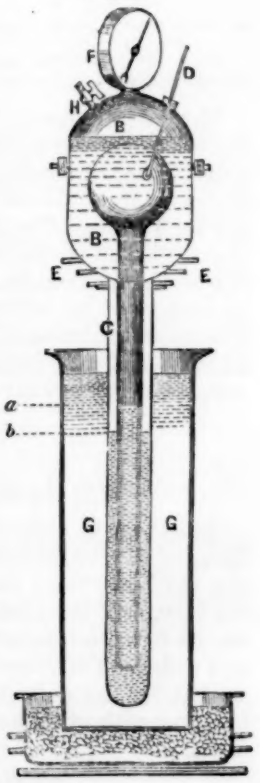
Fig. 1.



at this point the mercury column will rise at *a* and sink at *b*; this is the saturation test, and the cause of its action will be easily seen. So long as vaporization went on in both A and B, and the temperature was maintained uniform, each globe would contain steam of the same pressure, and the columns of mercury, *a* and *b*, would remain at the same level. But so soon as the water in *a* had vaporized, and the steam began to superheat, the pressure in *a* would cease to remain uniform with the pressure in B, and the mercury column would at once fall, and thus indicate the difference. The instantaneous change of the position of the mercury is the indication of the point at which the temperature in the bath corresponds with the saturation point of the steam in *a*.

To show the delicacy of this test, I may instance that at 290° Fahrenheit, the mercury column would rise nearly two inches for every degree of temperature above the saturation point, as the increase of pressure arising from vaporization is twelve times that arising from expansion in superheating at that point, and a similar difference exists at other temperatures.

Fig. 2.



The apparatus as employed for experiment, varies according to the pressure and other circumstances of its use. Fig. 2 represents one of the arrangements which has been employed with success. It consists of a glass globe of about seventy cubic inches capacity, in which is placed, after a Torricellian vacuum has been formed, the weighed globule of water. The globe with the stem is shown at A; this is surrounded by a copper boiler B B, prolonged by a stout glass tube C C, enclosing the globe stem. This copper boiler forms the water and steam bath through which the globe is heated, and in fact corresponds to the second globe B, in the former figure. The fluctuating mercury column, or saturation gauge, is placed at the bottom of the tube C C, and the saturation point is indicated by the rise of the inner mercury column *a*, and the fall at the same time of the outer mercury column *b*. As soon as the whole of the water in the globe A is evaporated, there is an instantaneous rise of the inner mercury column to restore the balance of pressure, and that progressively with the rise of temperature.

As an auxiliary apparatus the boiler is provided with gas-jets, E, to heat it, and with an open oil-bath G to retain the glass tubes at the same temperature as the boiler, and this oil-bath is placed on a sand-bath, and also heated with gas. A ther-

mometer D registers the temperature, and a pressure gauge F the pressure of the steam; and a blow-off cock H serves to reduce the temperature when necessary. A number of results have already been obtained, but they are not yet sufficiently advanced to be made public. The following numbers have been, however, approximately reduced from the theoretical formula above, and the experimental results may illustrate the use of this method of research. The most convenient way of expressing the density of steam is by stating the number of volumes into which the water of which it is composed has expanded. Thus one cubic inch of water expands into 1670 cubic inches of steam at 212° Fah., into 882 cubic inches at 251°, and into 400 cubic inches at 304°, and so on; in this way the following numbers have been computed:

Temperature	Volume of Steam. By Formula.	By Experiment.
244°	1,005	896
245°	969	890
257°	790	651
262°	740	680
268°	680	633
270°	660	604
283°	540	490

These determinations at pressures varying from ten to fifty lbs. above the atmosphere, are not accurate reductions from the experimental results, but only approximations. But they uniformly show a decided deviation from the law for perfect gases, and in the direction anticipated by Professor Thomson, the density being uniformly greater than that indicated by the formula. I hope by the time of the next meeting of the Association, with the assistance of my friend Mr. Tate, to be enabled to lay before the section a series of results which will fully determine the value of superheated steam, and its density and volume as compared with pressure at all pressures, varying from that of the atmosphere to 500 lbs on the square inch.

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*The Accident at the Polytechnic Institution.**

In one of the various actions against the directors which have been brought by persons injured by the falling of the stairs at the Polytechnic, the Lord Chief Baron of the Court of Exchequer, in addressing the jury, said that, from the evidence of Mr. Nelson, the accident occurred from an original defect in the stone, not visible on the surface, and which no one could detect. It would be their duty to return a verdict for the defendants, and he hoped the directors would not be harassed with other actions of a similar kind. Verdict for the defendants.

* From the London Builder, No. 855.

AMERICAN PATENTS.

List of American Patents which issued from October 4, to October 25, 1859, (inclusive,) with Exemplifications.

OCTOBER 4.

1. Stoves; James G. Abbott and Archilus Lawrence. Philadelphia, Pennsylvania.

Claim—The combination of the ring, perforated door frame, extending down over the ring and slide, with the stove cylinder.

2. Corn Planters; J. C. Adams, Greensburg, Indiana.

Claim—The arrangement of the clevis device on the rear of the pole, when said pole is received through the mortise in the bar, and when the said bar is made adjustable, by means of bolts and bolt holes, through its ends and through the frame pieces, said clevis device being made so as to clasp together cross-pieces.

3. Apparatus for Evaporation; Charles Alden, City of New York.

Claim—The agitator, so constructed as to be capable of acting as a blower as well as a stirrer.

4. Steam Gauge; Albert J. Allen, Buffalo, New York.

Claim—1st, Capsule, c, of peculiar construction, having the steam admitted at one side and through the centre of that side, and using the flexibility of both sides (such capsule being made of a permanently elastic metal, and not injuriously oxidized by steam or water, preferring for that purpose the metal used in making melodeon reeds), in combination with fulcrum block, lever, spring, rod, c, rod, 1, swivel block, radius bar, and segment, having tail-pin, pinion, index-pointer, dial plate, and friction pressure spring. 2d, Radius bar, in combination with rod, 1, swivel block, segment, having tail-pin, pinion, index pointer, and dial plate, having increasing divisions on its face. 3d, Swivel block, in combination with rod, 1, radius bar, and segment, having tail-pin.

5. Seed Planters; John P. Allen, Midville, Georgia.

Claim—The arrangement and combination of the frame provided with the armed hub, the hopper, and its bar, in connexion with the adjustable bar provided with the self-adjusting covering plate or bar.

6. Feed-water Apparatus for Steam Boilers; Thomas Armitage, Philadelphia, Pennsylvania.

Claim—The vessel, with its valve opening inwards, in combination with the pipes, with their respective cocks, and the drum arranged in respect to the boiler, as set forth.

7. Mole Plough; Henry F. Baker, Centreville, Indiana.

Claim—The arrangement and combination of the screw, key, knife, share, and revolving packer, as described. Also, the employment of a revolving mole or packer, as described.

[This improvement consists in attaching to the back part of the circular share a revolving, spirally-fluted frustrum of a cone, the share being fastened to the lower end of a cutting knife, and the furrow being pressed down by a following roller.]

8. Weeding-hoes; H. H. Baker, New Market, New Jersey.

Claim—The arrangement of the piece, standard, plate, concave, and ferrule, as described.

9. Rotary Harrows; O. D. Barrett, Cleveland, Ohio.

Claim—The arrangement of the hooks, draft bars, centre-pins, arms, and spring joint, as set forth.

10. Construction of Vapor Burners; Wm. W. Batchelder, City of New York.

Claim—Arranging the orifice of discharge from the retort, in reference to the open end of the gas pipe, so that the sediment from the orifice cannot fall into said pipe nor remain about and choke the orifice. Also, the entire disconnexion of the pipe and retort. Also, the combination of the circular form of the gas pipe with the horizontal discharge. Also, connecting the retort with the ascending part of the gas pipe near the burner.

11. Machine for Cutting Veneers; Mahlon Bonnell, City of New York, and Isaac J. Cole, Tappan, N. J.

Claim—1st, The arrangement of the cams, or their equivalents, in combination with the log-carrier. 2d, The arrangement and combination of the log-carrier with the tank, or its equivalent.

[A rotary log-carrier is employed, to the surface of which the logs are secured, so as to strike against a stationary cutter. As the logs rotate with the cutter they are dipped into hot water contained in a tank under the log-carrier, and the cutting operation is further facilitated by giving to the log-carrier a side motion, whereby a shear cut is produced and much power saved.]

12. Construction of Evaporating Apparatus; Nathaniel Bourne, Peosta, Iowa.

Claim—The arrangement and combination with the evaporating pan of a series of partitions and shutters, as described.

13. Apparatus for Laying Drain Tile; B. B. Briggs, Sharon, Ohio.

Claim—The described clutches, consisting of the block or body and the fingers, in combination with the rope, or its equivalent, and hook, arranged as specified.

14. Knapsacks; Robert C. Buchanan, United States Army.

Claim—The combination of the body yoke and end pockets to the knapsack, combined as set forth.

15. Brick Moulds; J. A. Buckwater, Kimberton, Pennsylvania.

Claim—The expanding frame formed of the movable plates and fitted within the frame, provided with the inclined or taper pendants and inclined slats, the plates being connected respectively to the pendants and slats by the pins and staples.

16. Measuring Faucet; Erastus Toncy Bussell, Covington, Kentucky.

Claim—Operating the cut-off by a rotary movement of the exhaust chamber, which comprises the measure proper, whereby the fluid is first admitted into said measure and then discharged therefrom. Also, a graduated plunger-rod, square or otherwise, so as to admit of stop notches on each side, independent of the others, into which a pin is forced by a spring.

17. SUPPORTING THE CARRIAGE BODIES OF FIRE ENGINES; Lysander Button and Robert Blake, Waterford, New York.

Claim—The propping of fire engines, which are mounted upon springs by means of cams, or mechanical equivalent thereof, so arranged and operated as, by lever power, to throw the weight of the engine from and upon the springs.

18. FIRE-PLACES; G. A. Clark, Farmington, Connecticut.

Claim—The described arrangement of caliducts, when the same are applied to a fire-place, in the manner set forth.

19. COTTON GINS; Powhattan Ellis Collins, Mobile, Alabama.

Claim—An adjustable hopper for changing and regulating the feed of cotton to a gin. Also, in combination with an adjustable and regulating hopper, the toothed cylinder for conveying the cotton from the hopper to the ginning or saw cylinder. Also, the arrangement of the hopper, feeding toothed roller, saw and brush cylinders, so as to operate in connexion with each other.

20. TRAY BOLT; Garrett Cooper, Jersey City, New Jersey.

Claim—The general arrangement of bolt, shield, ripple, and plate of metal, when said bolt shall effect its own spring, arranged in the manner described.

21. MANNER OF HANGING RECIPROCATING SAWS; Pearson Crosby, City of New York.

Claim—Connecting the two plates of the caps by means of rivets and pins, the ends of which are fitted in holes counter-sunk at the inner sides of the plates to admit of the vertical adjustment of the plates. Also, encompassing the rivets of the cap by tubes or cases to form a bearing for the plates, and prevent an undue pressure of the caps against the saw, so that the latter may be adjusted to compensate for wear—it being understood that I do not claim, broadly, the tubes or cases, but only when used in connexion with, or applied to, the caps.

22. BREAD AND VEGETABLE SLICER; Joshua and Sarah N. Davis, Muskegon, Michigan.

Claim—The arrangement and combination of the adjustable slotted plates, gauge, rod, spring, and lever, so that the slice of bread shall be supported by the gauge until the stroke of the knife is almost finished, and so that the gauge shall fall outwardly on the depression of spring.

23. BLIND FASTENER; William H. Davis, Taunton, Massachusetts.

Claim—The application to the catch, of a box, to secure it from getting out of place, and of the hook on the blind a rest to prevent the blind from sagging.

24. ACCOUNTANT LABELS FOR PERIODICALS, &c.; Robert Dick, Toronto, Canada; patented in Canada, July 6, 1858.

Claim—The contrivance of keeping accounts in printed form by the use of printer's type, or their equivalents, kept so arranged as to admit readily of all the re-adjustments which the currents of business may require, in manner set forth. Based on this primary invention, I also claim the device of rendering or transmitting accounts thus, or substantially thus kept in type, by sending printed impressions taken therefrom, though the particular form of sending may not be mine. While at the same time I claim, in the broadest and fullest, the special mode and form set forth by use of the machine described, as constituted by the combination of fluid vessel, reel, apron movement, and cutter stamp, which machine I also claim, with all the modes indicated for operating the same, and in connexion with the recited claims I thus formally make. Also, all other means and appliances, substantially the same as those claimed or intended to be claimed.

25. BORER FOR EXCAVATING MUD, &c.; Mason H. Ford, City of New York.

Claim—1st. The construction of revolving excavating scoops, provided either with openings and wings or flanches on its sides, capable of opening and shutting, or so constructed that part of the sides may be opened, and act in that position as wings or flanches, by which the dirt, mud, or sand is, during the revolving of the scoop, thrown into the inside of the scoop. 2d. The manner of attaching scoops to the shafts, so that the same will be made to turn with the shaft when the same is revolving and at the same time capable of being raised above the surface of the water, when filled, for the purpose of being emptied, without requiring to raise the shaft.

26. COOKING STOVES; Peter Getz, Lancaster, Pennsylvania.

Claim—The specific arrangement of the boilers, drum-head oven, and their combination in manner as set forth.

27. WEIGHING SCALES; William D. Guseman, Morgantown, Virginia.

Claim—The triangular recess cut out on the under side of the journals of the pendulum drum or shaft, to enable said drum to swing or roll on its axis on the upward pointing-knife edges. Also, in combination with an upward pointing-knife edge, a roller or pendulum drum, the journals of which are formed with triangular recesses and a counterpoise weight, or its equivalent, vibrating below the centre of the drum or roller, and this I claim whether the counterpoise be adjustable on its lever or not.

28. STAVE MACHINE; Henry Hays, City of New York.

Claim—Dressing staves by a continuous operation, regardless of length or thickness, by the combined action of the feed rollers and cutters, when said parts are arranged to remove a shaving from the outer side of the stave, under all circumstances, and split out more or less from the inner side to reduce the stave to a uniform thickness.

29. STEAM BOILER; Joseph Harrison, Jr., Philadelphia, Pennsylvania.

Claim—The construction of a boiler of distinct globular or spherical parts, single or in groups, united in the manner specified, or any other analogous thereto, and wherein the strength of the globular form of such parts is common to the entire structure; this claim being intended to include not true spheres only, but elliptical, conical, polyhedral, or any other analogous forms also, where the results looking to strength and construction of the boiler, are substantially the same as those enumerated. Also, the employment, as units of construction, as hereinbefore explained, of separate chambers of cast iron or other metal, of uniform size and shape, substantially as described, to be used as wanted, wherewith boilers of different forms and dimensions may be built up, being united together in the manner specified, or any other analogous thereto. Both of the above claims involve an outside casing for the particular construction, with furnaces, substantially as described. It is not, however, my intention to confine myself to any special form of boiler or mode of casing the same

30. DEVICE FOR CONNECTING THE PANELS OF PORTABLE FIELD FENCES; Joel Haines, West Middleburg, Ohio.

Claim—The jointed link for connecting the ends of the panels, so arranged that by using a tapering key

in the link, the angle of a zigzag fence may be made more or less obtuse, as required, to make the fence stand firm in the position in which it is placed.

31. PUMPS; W. M. Henderson, Baltimore, Maryland.

Claim—The two ball valve cages, with the suction valves in the interior, attached to the extremity of a central perforated tube, or its equivalent, in combination with the water-ways and discharge valve, constructed in the manner set forth.

32. FAUCETS; Thompson Hersee and Pierre Jos. Bourgnon, Buffalo, New York.

Claim—1st, The relative arrangement of the valve, chamber and spherical part, in combination with the plug, said valve having a lifter and stem, operating as described. 2d, The combination and arrangement of the lifting rod, valve, tube, and pipe, with the cross-piece, for the purpose of ventilating the barrel at each draft.

33. CURTAIN FIXTURE; John B. Holmes, Jr., City of New York.

Claim—The spring, in combination with the roughened, V-shaped, grooved pulley, an endless cord or band, arranged as specified. Also, the brackets, c c', provided with the centre-pins entering the roller ends, in the manner specified. Also, forming the bracket, c, with the slot and open ring, and the bracket, c', with a hook-shaped slot to afford opportunity of removing the whole of the parts without having to draw the screws or nails passing through said brackets.

34. SIGNAL LANTERNS; Lewis Hover, Flushing, New York.

Claim—The arrangement and combination with the case and lamp, of the metallic cylinder and glass cylinder, as described.

35. TOOL FOR CUTTING GAS PIPE; Job F. Howland, City of New York.

Claim—The arrangement of a stationary iron frame with a slot in it, which terminates in a conical form at one end, in combination with a sliding jaw having a V-shaped tongue, and with an adjustable sliding cutter.

36. MODE OF DISINFECTING FEATHERS; J. W. Howlet, Greensboro', North Carolina.

Claim—The injection of combined steam and chlorine gas among the feathers, as described.

37. VEGETABLE CUTTER; B. C. Hoyt, Port Washington, Wisconsin.

Claim—The arrangement of the cutting-box upon a vibrating lever, when the lever is supported by a spring, actuating arm, for keeping the whole in an elevated position. Also, the combination of slide, angular slotted box, and vertical cutters, arranged in the manner set forth.

38. MOLE PLOUGHS; Rameth Hussey and Uriah Thornburgh, Sr., Walnut Run, Ohio.

Claim—Suspending the plough-beam that carries the mole to the plough-frame by means of ropes or chains, connecting its ends to one capstan, in combination with suitable catches for holding it at any adjusted height thereon. Also, in combination with the rotary mode, suspending the plough-beam by both its ends to ropes or chains which connect with a common capstan on the plough-frame, in combination with racks and pawls for holding said beam when adjusted.

39. SPARK-ARRESTERS; I. E. Jones, Cincinnati, Ohio.

Claim—The arrangement of the tank, wind-wheel, and agitator, with reference to the receiving trunk and valve.

40. ROTARY HARROWS; M. C. Kilgore, Washington, Iowa.

Claim—The arrangement and combination of the windlass, arms, socket, collar, harrow, and spindle, as described.

[This invention consists in suspending from a pivoted collar, fixed centrally to a shaft mounted upon wheels, a rotary harrow supported or swung by chains or cords which pass round a windlass, so that the harrow will be rigidly attached to the frame or axle of the machine, at the same time it can be raised or depressed, or inclined to the surface of the ground.]

41. ATTACHMENT TO TREADLES OF SEWING MACHINES; H. B. Knowles, Providence, Rhode Island.

Claim—The employment of a yielding adjustable rod, having a cross-head with hooks at its upper end, in combination with a shackle-bar, crank-shaft, and treadle, as set forth.

[The object of this invention is to prevent the crank of a sewing machine, or of any other machine which may be operated by a treadle, from slipping on to the dead point, and to connect the treadle to the crank in such a manner that the machine can always be started with the foot in the right direction, while it is impossible to turn it in the wrong direction, except by force or by the aid of the hands. A spring is connected to the shackle-bar in such a manner that it begins to act on the same as the crank approaches the dead points. When the machine is turned in the right direction, the spring pushes the crank beyond the dead points; but if an attempt is made to turn the crank in the wrong direction, said spring opposes its passing the dead points.]

42. PUNCHING METALS; Philip Koch, New Haven, Connecticut.

Claim—1st, The employment or use of a series of arbors to which punches or shear blades are attached, fitted in a rotating or adjustable head, when said head is connected with an arbor having a plate attached, provided with bolsters and shear blades, corresponding with the punches and shear blades of the head. 2d, The means employed for actuating the yoke and consequently the arbors, to wit: the adjustable shaft, E, provided with the eccentric, J, pin, W, fitted within the block of yoke, the adjustable shaft, F, provided with the lower crank and the recess in the back part of plate to receive pin, W.

43. PLOUGHS; E. D. Lee and Z. W. Lee, Blakely, Georgia.

Claim—The arrangement of the peculiar curved clevis, beam, curved rod, bar, band, wedge, shank, projection, and share, as specified.

44. SAFETY APPARATUS FOR STEAM BOILERS; L. E. Lincoln, Lowell, Massachusetts.

Claim—The application of a low water alarm to more than one boiler (or to one), by means of a two or more legged tube, a simple or a compound siphon, in such manner that said tube shall keep said alarm charged with water, when all its pendant ends are covered by water, and shall cause said alarm to be supplied with steam, when any one of its pendant ends is exposed to steam.

45. MANGLE; W. T. Littejohn, Kalamazoo, Michigan.

Claim—The arrangement of the levers with roller at their upper end, the spring, bar, connected to the treadle by the rope, in combination with stationary roller.

46. MUSICAL NOTATION FOR THE BLIND; Cornelius Mahoney, City of New York.

Claim—The combination of letters and characters, or notes, in embossed print, so as to represent music for the blind.

47. VALVES FOR RETARDING AND ARRESTING THE FLOW OF GASES; Newton S. Manross, Bristol, Connecticut.

Claim—The use of a re-curved or V-shaped tube or passage, having its lower part connected with a well or reservoir, containing quicksilver, which is made to rise within the tube by means of a plug, or other equivalent pressure. Also, the combination of such re-curved tube, closed by quicksilver, with the regulating apparatus, consisting of a tapering shoulder and movable rod, secured from leakage by passing through the quicksilver.

48. COFFINS; H. Marshall, Cincinnati, Ohio.

Claim—A coffin having its bottom ends and sides wholly constructed of corrugated sheet metal, which is rolled or stamped into proper form, and surrounded at the upper edge of its body with a wrought or cast iron frame, which serves as a brace to the body and a hold-fast for screws.

49. HYDRANTS; N. B. Marsh, Cincinnati, Ohio.

Claim—The arrangement, in connexion with the main casing, discharge pipe, and air chamber, of a hydrant of the upper and lower plunger or valve chamber, made in one piece, upper plunger or valve, when composed of parts, k l m n r, and lower conical guide and stop-plunger, composed of parts, s h i, in the manner described.

50. BREECH-LOADING FIRE ARMS; J. Plympton Marshall, Millbury, Massachusetts.

Claim—1st, The combination of the lock bolt (of the movable breech), or its equivalent, and the discharging lock of the arm, with intermediate parts. 2d, Arranging the lock for the tape-primers, in the manner described.

51. CONSTRUCTION OF PRISONS; Edwin May, Indianapolis, Indiana.

Claim—1st, The angle door, in combination with the safe lock or bolt, constructed as set forth. 2d, The safe containing the drum and bolt, and being held by the outer door, constructed as set forth. 3d, The endless chain or rope, in combination with the levers, constructed as set forth. 4th, The combination and arrangement of the levers, bar, and bolts or lugs, operated from without the grating, as set forth.

52. BACK-SIGHT FOR FIRE ARMS; Edward Maynard, Washington City, D. C.

Claim—1st, The grooved cylindrical end of the sight carriage, in combination with a spring-bolt or pin, of such form that it shall fall into the grooves and bear against their two sides, and yet not touch the bottoms of the grooves, so that, as it wears, it will still press on the side of the grooves, and hold the carriage firm in either of its positions. 2d, Placing the spring and its bolt or pin within the stock or breech of the gun for its more perfect protection from wet and damage by accident, the opening through which the pin acts being susceptible of being closed without oil or packing.

53. NIPPLES OF FIRE ARMS; Edward Maynard, Washington City, D. C.

Claim—The permanent union of a cap or nipple with the closed end of the tube, whose open ends have screw-threads formed within it, by which I am enabled to combine the said nipple and its tubular seat with the abutment of the breech piece of a fire arm, by means of a transverse perforation in said abutment, for the reception of the tubular nipple-seat, and a nick headed screw inserted in the left-hand of said perforation, and working into the screw-threads in the open end of said tubular nipple-seat.

54. SKATES; John McCluskey, Jr., South Boston, Massachusetts.

Claim—The jointed heel strap, in combination with the toe strap, when the latter is made longitudinally adjustable upon the runner.

[The invention further consists in hinging the heel strap and plate to the rear of the runner, and fixing it rigidly thereto when the skate is on the foot, by a suitable spring-catch or thumb-screw.]

55. WINDOW-SASH SUPPORTER; Wm. Howard Mitchell, San Francisco, California.

Claim—1st, The roller, arranged on an angular double-jointed arm, so as to have slight play up or down between two stops, accordingly as it is operated on by a spring or the weight of the sash. 2d, The combination of the angular double-jointed arm, spring, thumb-piece, friction roller, and semicircular recess in the window frame.

56. GOLD-WASHER; Mortimer Nelson, City of New York.

Claim—1st, The combination of a series of concave plain pans with a series of convex rifled pans, said pans all being arranged on the same vertical shaft. 2d, The arrangement of a horizontal cam wheel, ball, horizontal friction roller, two bevel wheels, a rising and falling driving shaft, and a collar on the vertical shaft. 3d, The combination of a revolving perforated platform or grating with a non revolving but yielding raking device. 4th, The combination of the stationary case with the revolving perforated platform, raking device, and the horizontally-revolving pans.

57. COMPOSITION FOR SOAP; Nelson Orcutt, Binghampton, New York.

Claim—Making soap from untried or unrendered tallow or grease, and the other ingredients named, the ingredients being in the proportions as stated.

58. COMBINED TABLE AND CLOTHES-DRYER; Lewis Pagin, Elmore, Ohio.

Claim—A combined table or stand and a clothes-dryer, composed of a table or stand, with a reversible top, and a box, drawer, or recess, and two or more jointed arms that will fold up and lie within said box, drawer, or recess.

59. UPHOLSTERY NAIL; Benjamin S. Pardee, Mount Carmel, and Thomas Rawlings, New Haven, Connecticut.

Claim—The paper-headed nail or tack, as described.

60. COMPOSITION FOR TANNING; Seneca Pierce and Frederick F. Beadsley, Castle Grove, Iowa.

Claim—A composition for tanning, made of terra-japonica, alum, glauber salts, and saltpetre, in the proportions and manner set forth.

61. MODE OF RESTORING RANCID BUTTER; Josiah W. Prentiss, Pultney, New York.

Claim—The mode described of restoring rancid butter in the firkin by removing the hoops so as to open the joints enclosing it in a bag, or other textile fabric, and then surrounding the whole with charcoal.

62. MACHINE FOR LASTING BOOTS AND SHOES; James Purmton, Lynn, Massachusetts.

Claim—The clamps, in combination with the slides, said clamps and slides being carried to their place by their levers, or their equivalents. Also, the opening and closing slide; also, the roughing or cutting slide.

63. LATHE CHUCK; Edward A. L. Roberts, City of New York.

Claim—The application and use of the ball and socket joint, in combination with the mandrel or chuck of lathes.

64. CORN PLANTERS; Christian Ropp, McLean County, Illinois.

Claim—The arrangement of the dog-wheel, levers, stops, u and u', with stops, f, springs, bent rods, and feed wheels, constructed as set forth.

65. CHEESE VATS; O. Sage, Wellington, Ohio.

Claim—The combination of the furnace and smoke-pipe with the open and curved bottom of the water box, pipe, equalizer, and milk box, arranged as set forth.

66. GRAIN SEPARATORS; Jacob Seebold, New Berlin, Pennsylvania.

Claim—Attaching the separator to the thresher by rocking frames, in combination with wheel, rod, slotted arm, and springs, for producing its reciprocating motion.

67. SURVEYING INSTRUMENT; Samuel R. Seibert, Munising, Michigan.

Claim—Constructing the "Ys" or supports of the telescope in a surveying instrument, as set forth—also, constructing a clamping pinion, in the manner described.

68. DIVIDERS FOR HARVESTERS; J. H. Shireman, East Berlin, Pennsylvania.

Claim—The combination of the adjustable case with the stationary horizontal dividing point, arranged in the manner set forth.

69. OYSTER DREDGES; Thomas P. Sink, Fairton, New Jersey.

Claim—The arrangement and combination of the chuck or block and its pulley, with the roller, in the manner set forth.

70. SAW-SET; Seymour Smith, Sharon, Connecticut.

Claim—The mill saw-set described, the several parts A, B, and F, being arranged in the manner set forth.

71. COVERING COFFINS; Leonard Snyder, Indianapolis, Indiana.

Claim—Using and applying flock as a covering for coffins, whether the same is prepared or secured, or in the manner set forth, or in any other manner substantially the same.

72. HYDRANTS; Charles L. Stacey, Cincinnati, Ohio.

Claim—The relative arrangement of the cup-formed discs and the apertures, adapted in the manner set forth, to form a chamber closed on all sides (with the exception of the ingress aperture) while the hydrant is open, for the purpose of expanding the flanches, and upon the closing of the hydrant to uncover the aperture, and thereby empty the discharge pipe.

73. MODE OF ATTACHING SABRES TO BELTS; James E. B. Stuart, Wytheville, Virginia.

Claim—The attachment hook, in combination with the ring, or its equivalent, attached to the waist belt, the whole being constructed as set forth.

74. SEED PLANTERS; W. H. Stuart, Millington, Maryland.

Claim—1st, A double corn planter, the parts of which are arranged to operate as described. 2d, Connecting the two independent sets of valves by means of the flexible connexion, in combination with single-operating chain or cord, as set forth.

75. CONSTRUCTION OF GAS BURNERS; H. K. Symmes, Newton, Massachusetts.

Claim—The combination with the inverted cup and tube and the quicksilver basin or basins, or their equivalents, forming a movable connexion between the base and tip of the burner, operating as described, of the pawl-like rod, or its equivalent, attached to the cup, and a rest for said rod attached to the base of the burner, the whole operating as described, to shut off the gas from the tip by the temporary increase and subsequent reduction of the pressure in the pipes.

76. TILE MACHINES; George S. Tiffany, Palmyra, Michigan.

Claim—The extension of the flanched feeding shaft, so as to form a revolving core, operating as described.

77. CORN SHELLERS; George W. Tolhurst, Liverpool, Ohio.

Claim—The flexible hinged apron, in combination with the disc and flanch wheel, in the manner described.

78. SPRING BED-BOTTOM; Philip Ulmer, City of New York.

Claim—The method described of connecting the spring, or its equivalent means, by which the same is secured in place by contact between compressing surfaces.

79. CORN PLANTERS; Rufus M. Varmer, Oxford, Mississippi.

Claim—The arrangement of the table, delivering tube, furrow plough, feeding disc, hopper, all attached to the rear end of the tongue, and placed between, and subject to the action of, the straps and the springs. Also, the combination of the spaces of the hopper's side with the india rubber strip, the beveled edge of the hopper's bottom, and the gouged holes of the feeding disc.

80. MACHINES FOR HOISTING ICE; John Wagner, Philadelphia, Pennsylvania.

Claim—1st, The combination of the slides, carriages, supporters, and projections on the chutes, arranged in the manner specified. 2d, The anti-friction rollers in connexion with the slides, arranged as specified. 3d, The counterbalancing rope or chain and rollers, in combination with the pulley and the slides, operating in the manner specified.

81. SEWING MACHINES; Kasimir Vogel, Chelsea, Massachusetts.

Claim—1st, The employment, in combination with two or more needles, or their equivalents, which work together to perforate or pass from one side to the other of the cloth, or other material to be operated upon, and with suitable means of carrying a locking-thread through the loops of the threads of those needles; of a thread conductor, so applied and operated as to effect the interlacing of the threads of said needles on the opposite side of the material to that on which they are interlaced with the locking-thread, whereby they are made to produce the different kinds of stitching represented. 2d, The employment of a movable needle-plate, containing two or more needle-holes, of different size, form, or arrangement, applied to the bed-plate or work-plate of a sewing machine, in such a manner as to be capable of adjustment to bring either of its holes into position for the proper needle to work in it.

82. GUIDE-RINGS FOR FISHING-RODS; Henry Pritchard, Brooklyn, New York.

Claim—The combination of the fixed ferrule and the movable thimble with its eye, constructed as set forth.

83. FURNACES; John I. Vinton and Edward John, Ironton, Ohio.

Claim—The employment in reverberatory furnaces of the water space, constructed and fitted in place in the manner set forth.

84. CLOTHES-CLAMP; Chapman Warner, City of New York..

Claim—The mode of securing, between the buttons A and C, the garment, or whatever else may be placed between them, by means of binding or wedging effect of the pin in the hole of button, C, with the spiral spring, as specified.

85. MACHINERY FOR TRIMMING WALL-PAPER; A. L. Whipple, Elmira, New York.

Claim—The manner of constructing the spool with fixed rotating head and yielding head, in combination with the movable bed for holding the roll firmly in the proper relative position to the knives.

86. HARVESTERS; David Zug, Shaefferstown, Pennsylvania.

Claim—The combination of the brace with the gum-elastic stuffing-box and the supporting bar, arranged in the manner described.

87. KNITTING MACHINES; Wm. Binkley, Assignor to Samuel N. Bell, Manchester, New Hampshire.

Claim—The hollow cone cut off elliptically, and with the parallel elliptical cam on its inner surface, together with the projection on the lower side, supported by the shaft passing through the hollow shaft, and attached to the arm of the standard, or other equivalents.

88. CORN HARVESTERS; Waldren Beach, Assignor to self and John L. Reese, Jr., Baltimore, Maryland.

Claim—The vertically adjustable cutting apparatus, in combination with rests, lever, jointed arms, and spring, operating as set forth.

89. STRAW-CUTTERS; A. D. Brown, Assignor to Sallie C. Brown, Columbus, Georgia.

Claim—The arrangement and combination of the yielding strips and constituting guard, with the wheel, sash, and trough, as described.

90. SKELETON SKIRTS; James Draper, Assignor to self and Samuel H. Dougherty, City of New York.

Claim—The skeleton skirts described, in which the hoops are secured by glue, or equivalent cement, between separately woven parts of the tapes, in contradistinction to the stitched or clasped skirt when the parts are woven together as single tapes between the hoops, and separately as distinct tapes, at the points where the hoops are received.

91. CONSTRUCTION OF DENTISTS' CHAIRS; Nathan C. Lewis, Jr., Assignor to self and Edwin Bruce, Boston, Massachusetts.

Claim—The combination of the adjustable body-rest with the chair. Also, the combination of the auxiliary or elbow-rest and the body-rest, applied to a chair. Also, the mode of applying the body-rest to the elbow-rest, that is, by means of an adjustable arm, applied and operating with respect to the elbow-rest, as set forth.

92. LINING UNDERGROUND DRAINS; James C. Miller, Irwin, Ohio, Stillman A. Clemens, Rockford, Illinois, and Gilbert H. Clemens, Urbana, Ohio.

Claim—1st, The method of making covered field-drains by lining the inside with hydraulic lime, mortar, or other suitable material. 2d, A conducting tube connected with a coulter. 3d, A forcing bar, with valve pistons attached, and working in a conducting tube. 4th, A follower of less transverse dimensions than the mole to which it is attached.

93. ROTARY DREDGING MACHINE; James Molyneux, Bordentown, New Jersey, Assignor to the Bordentown Machine Company.

Claim—1st, The combination and arrangement of devices for raising, lowering, and holding the levers, C C, which support and carry the dredging wheel as required. 2d, The rams on the dredging wheel, for the purpose set forth. 3d, The chute, hinged so that it may be raised when the socket passes under it, and lowered to receive the contents of the bucket. 4th, And, in combination with a hinged chute, I claim the arm on the wheel, just before the bucket, for the purpose of raising the chute and allowing the bucket to pass under it. 5th, A chute arranged to traverse on ways, so as that it may be adjusted to the dredging wheel. 6th, The levers and links, arranged for the purpose of traversing the chute. 7th, The traversing bars, armed with picks or chisels, and arranged to operate on the bottom of the river, in advance of the dredging wheel. 8th, The shaft and wipers, in combination with the traversing bars, carrying picks, chisels, &c., for the purposes specified.

94. CONSTRUCTION OF DISTILLING APPARATUS; John Sloan, Assignor to self and Eberhard H. Dierker, Pittsburgh, Pennsylvania.

Claim—1st, The combination and arrangement of the condensing worm or pipe, the wheels, the receiving chamber, with the governor and valve, for the purpose of regulating the quantity of steam in the heating pipe. 2d, The combination and arrangement of the chambers with the conducting pipes, when used in connexion with the condensing worm or pipe, as described.

95. TRACE-TRIMMER; Adolph Stempel, Assignor to self and Owen McFarland, Newark, New Jersey.

Claim—1st, The arrangement and combination of the vertically sliding spring bar, laterally adjustable bed-pieces, and suspended curved cutters. 2d, In combination with the bed-pieces and cutters, I claim the adjustable jaws, or their equivalents, arranged as specified.

96. MOULDING STOVE-COVERS; David L. Stiles, Assignor to John M. French & Co., Rochester, New York.

Claim—The employment of the cone-form plugs and pivoted thumb-levers, in combination with that portion of the pattern which forms the recess of the cover.

97. RAILROAD CAR BRAKES; William F. Stewart, Patuxent Forge, Maryland.

Claim—The combination of the various parts of the apparatus described, when so constructed and arranged in relation to the means by which they are actuated as to apply and release the brakes upon the whole train, upon sections or upon single cars, by the engineer, or by one or more of the brakemen, or by all or part of them, collectively or individually, the brake apparatus of each car or of each section being complete in itself when the cars are uncoupled or the train divided into sections.

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98. ROPE-NIPPER; W. H. Allen and A. J. Bentley, City of New York.

Claim—The rope-pinchers, composed of the grooved pivoted jaws and levers, as described.

99. GALVANIC BATTERY; Thomas C. Avery, City of New York.

Claim—1st, The use of the insulating amalgam, in combination with the surfaces of the zincs of galvanic batteries for telegraphic purposes, for obtaining the results before set forth. 2d, The use of two or more independent strips of platinum in the construction of galvanic batteries for telegraphic purposes, as an improvement on the Grove Battery, for the purpose of obtaining the results before set forth, but irrespective of their use, in combination with the insulated amalgamated zincs before described.

100. MACHINE FOR BENDING WOOD; Augustus Bailey, Gardiner, Maine.

Claim—The combination of the aforesaid horizontal sliding roll and graduated hook with the semi-cylinder, acting in the manner described.

101. COMPOSITION FOR PAINT OIL; J. D. Baldwin, Columbus, Georgia.

Claim—The paint oil, composed of the ingredients specified, essentially in the proportions named and prepared, as described.

102. STEAM BOILER FURNACES; W. D. Ballard, Kansas City, Missouri.

Claim—The arrangement of the fire-place, the partitions of the setting, and the chimney, as described, with the two-flued boiler.

103. SIGNAL-BELL; G. F. and D. H. Benckert, Philadelphia, Pennsylvania.

Claim—1st, The latch, operating with the hammer and pull-bell, with the one spring. 2d, Placing the working parts of a signal-bell within the sounding box, as specified.

104. HEMMING-GUIDES FOR SEWING MACHINES; S. E. Blake and Thomas Johnston, Louisville, Kentucky.

Claim—1st, The combination and arrangement of the spiral tongue, flanched roller, and yielding plate, for the purpose set forth. 2d, The spring plate, constructed as described, with an oblique slot in the limb, combined with the adjustable gauge. 3d, The yielding pressure roller, adapted and applied to smooth and flatten the hem previous to stitching.

105. CONNECTING RODS APPLIED TO CRANKS; Reinhold Boeklin, Jersey City, New Jersey.

Claim—Giving the rod elasticity, both longitudinally and in a lateral direction, parallel with the plane of revolution of the crank, by extending it in the form of a bow or arc beyond the crank-pin or wrist, and making such bow elastic.

106. MACHINES FOR BREAKING AND CLEANING HEMP; J. K. Booton, Luray, Virginia.

Claim—1st, The combination and arrangement of the cylindrical grating and lever arms, and swords, and concave grating, with the hurder cylinder, formed with alternate plane edges and serrated ridges or ribs. 2d, The combination and arrangement of a fan or blast wheel with the hurder cylinder and endless apron.

107. TELEGRAPHIC MACHINE; L. Bradley, Folsom, California.

Claim—1st, Arranging the type and mechanism for closing the circuit, as described, or in an equivalent manner, so that a double closing of the circuit is effected, as each tooth of the type comes in contact with the closing mechanism. 2d, The combination of the type and composing sticks with a yielding insulating plate, carrying the mechanism for breaking and closing the circuit, whereby the contact of the closing mechanism with the face of the type is insured. 3d, The vibrating hook and bar, or their equivalents, in combination with a yielding insulating plate, and type, and sticks, for the purpose of closing the circuit. 4th, The combination of the composing stick and type with the spring, or its equivalent, arranged so that the type are made to form a portion of the circuit. 5th, The combination of the carrying band and mechanism for closing the circuit, with the composing sticks and type arranged on the band in relation to each other, so that the sticks are successively carried forward in the order in which they are arranged, brought into the current, and the message transmitted without interruption. 6th, The combination of the movable platform carrying the recording mechanism with the rotating cylinder carrying the record paper, arranged so that the message as transmitted is recorded in parallel lines on the paper. 7th, Constructing the composing sticks and types, so that the sticks, when filled with the type, shall present an even and flat surface on either side. 8th, The application of a siphon pen, for the purpose of recording the messages. 9th, The inclined plane, arranged in combination with the band, whereby the composing sticks are received from the band in such manner as not to interfere with each other's delivery, and in the same order in which they were placed on the band.

108. REFRIGERATOR; T. B. Burtis, Chicago, Illinois.

Claim—The employment or use of the ice chamber, water chamber, air passages, and a series of provision chambers.

109. GRATE-BARS; John Buzby, Moorestown, New Jersey.

Claim—Making the mortises and the tenons on the grate-bars, alternately, one above the other, so that the mortises may be made entirely through the bar, without interfering with the tenons, and so the tenons may extend entirely through the bar without interfering with one another, and be made so long as not to be drawn out of the mortise by the warping or springing of the grate-bars.

110. POTATO-DIGGERS; A. S. Capron and D. S. Davis, Grass Lake, Michigan.

Claim—The arrangement of axle, wheels, and wheel, pinion, crank, and shaft, guides, roller, rake, apron, and hooks, connected together and operating as specified.

111. OPERATING THE VALVES OF STEAM ENGINES; Tisdale Carpenter, Providence, Rhode Island.

Claim—The adjustable, graduated, scroll-shaped side cam, so arranged as to be traversed and adjusted by a regulator or governor, while the engine is in motion, or adjusted and fixed or set by hand while the engine is stopped.

112. AWNINGS; Samuel Chace, Providence, Rhode Island.

Claim—The application of the gear-toothed tracks with the pinions; also, the dogs; and finally, the box or covering to an awning, constructed as set forth.

113. GASKET FOR STEAM AND OTHER JOINTS; James S. Colvin, Allegheny, Pennsylvania.

Claim—A joint gasket, composed of a ring of india rubber, encased with copper or other metal, as described.

114. SPRING-BACK CARRIAGE SEATS; Norman Cowles and A. Hulbert, Edgefield, South Carolina.

Claim—The employment of springs, when in connexion with a back supported by hinged uprights, in the manner set forth.

115. HAND MACHINE FOR WIRING BLIND-RODS; Biram C. Davis, Binghampton, New York.

Claim—1st, The setting form which sets over the rod and straddles the slats, and which is secured under the blind by means of the stationary bar, in such a manner as to let the staples through the eye of the staple in the rod into the slats; D D being the equivalent means employed for setting the staple into the rod, in combination with the adjustable arrangement, operating as described. 2d, In combination with the form, the joint lever, flanch rod or drivers, dividing slide, and inclined needle-bar.

116. WHEELWRIGHT MACHINE; E. Dougherty, Cedarville, Ohio.

Claim—The combination of devices, as specified.

117. SHUTTER HINGE; H. F. Drott, Cumberland, Maryland.

Claim—The employment of the spring, as constructed, when used in connexion with the plate, as constructed, the two being used in combination with any common shutter hinge.

118. FURNACES; B. Wells Dunklee, Boston, Massachusetts.

Claim—The general arrangement of the space, the chamber or dome, I, the dampers, M N, and pipe or T-L, and the ventilating pipe, S, and smoke-drum, and ventilating pipe, P, and smoke-pipe, T, and air duct, and series of dampers in flues, F, in relation to each other and with respect to the flue, F, and hot air chamber, E.

119. SEWING MACHINES; Wm. O. Grover and Wm. E. Baker, Boston, Massachusetts, and O. B. Potter, City of New York.

Claim—A non-penetrating instrument and a piercing eye-pointed needle, acting together to make an interlocking of threads, in combination with a clamping apparatus, acting as specified, and acting to make a double-looped stitch. Also, mounting a spool or bobbin, from which thread is to be delivered, for the purpose of sewing by machinery upon two truncated cones.

120. BEE-HIVES; Horace Gushee and John G. Dawes, San Francisco, California.

Claim—The combination of the comb frames, rods, staples, and cleat, whereby the comb frames may be readily removed or inserted, in the manner described.

121. BEDSTEAD; John R. Guy, Springfield, Ohio.

Claim—The arrangement of the frame with reference to the heads, and their connexion by means of the joints, and slides, and plates, or their equivalents, as described.

122. DOUBLE-FRICTION COUPLING; Joshua Hendy, San Francisco, California.

Claim—The application of two such truncated cones to one coupling (one at either end), and operated by a single lever, so as to work in cavities or conical sleeves attached to pulleys or wheels, arranged on one shaft, so that said shaft may be run slow or fast, or backward or forward, or entirely stopped, without stopping the prime-motor or changing its speed.

123. STEERING APPARATUS; Hatsel Higgins, Orleans, Massachusetts.

Claim—The arrangement of the rudder head intermediately between the supports which, respectively, serve as bearings to the hand-wheel shaft and the rudder-operating gear, said shaft extending back of and over said gear, whereby the rudder may be operated either by the gear or by a tiller from the wheel shaft, as described; and also compactness of steering apparatus and economy of deck space is obtained.

124. HOT-AIR FURNACES; Isaac H. Hobbs, Abraham W. Rand, and George H. Sellers, Philadelphia, Penna.

Claim—1st, The general arrangement of the subdivided air chamber, in connexion with the separate receiving and discharging openings. 2d, The deflecting diaphragms, in combination with the above described arrangement, in the manner set forth.

125. ROTARY HARROWS; Sidney S. Hogle, Cleveland, Ohio.

Claim—The combination of a series of individually rotating toothed frames or wheels, with a rotating central frame or wheel, in such a manner that the said parts will operate in the manner set forth.

126. CLOTHES FRAME; D. E. Holmes, Halifax, Massachusetts.

Claim—The combination of the standards and horizontal hinged frames, when the same are sustained and braced by slotted braces, in the manner set forth.

127. PLOUGHS; Bold R. Hood, Clinton, North Carolina.

Claim—The combination of the standard, D, standard, C, and land slides, when the parts are constructed as described, and adapted to receive the various forms of shovel points and mould-boards in use.

128. TELEGRAPHIC CABLE; William H. Johnson, Springfield, Massachusetts.

Claim—An electric telegraphic conductor, constructed in the manner set forth.

129. OMNIBUS REGISTER; W. M. Keague, Brooklyn, New York.

Claim—1st, The arrangement and combination of the platform, vibrating lever, and adjustable spring, as specified. 2d, In combination with the platform and spring, I claim the sliding bar, spring catch, and wheel. 3d, Arranging the step, in combination with the registering apparatus, as described, so that it registers half-fares as well as full fares.

130. HYDRAULIC MOTORS; Miles Keely and G. W. Cressman, Barren Hill, Pennsylvania.

Claim—The arrangement and combination with the levers, lever frames, and bottoms of the adjustable slots and bars, by which the speed of the machine, length of stroke of the levers, and distance of water may be regulated at pleasure.

131. TEA KETTLES; Archibald C. Ketchum, City of New York.

Claim—The combination of the tin top, copper bottom, and sheet iron skirt, when the same are all united by one and the same lap-joint, and just below the spout of the kettle.

132. ENDLESS CHAINS FOR HORSE POWER MACHINES; Isaac R. Lawrence and George E. Gould, Green Island, New York.

Claim—1st, Extending both the lugs and the links of such chains to or beyond the treads of the friction wheels, carried by axles cast on the links. 2d, Forming and arranging projections on the links of the chain, the links being provided with male lugs and female lugs.

133. Straw-cutters; Lucius Leavenworth, Trumansburg, New York.

Claim—The arrangement and combination of the rockers and springs, for the purpose of giving a double motion to the knife, and to avoid friction of the working parts.

134. Apparatus for Stirring and Delivering Grain; Sylvester Marsh, West Roxbury, Massachusetts.

Claim—1st, The combination with the reticulated bed or other suitable drying table, of a reciprocating truck, armed with paddles or stirrers for agitating the grain on the drying surface. 2d, The arrangement of the truck paddles in rows, one in advance of the other, and the paddles of each preceding row intermediate of those next behind them. 3d, Giving to the paddles of the reciprocating truck an oblique set for and during the forward travel of the truck, and giving them an edge presentation or set for and during the back travel of the same, as set forth. 4th, Giving to said paddles reverse obliquities, for and during the forward travel of the truck, so as to throw the grain to the right and to the left, alternately, in the feed forward of the grain by the paddles. 5th, The combination with the reciprocating truck and its paddles, of a cross sliding frame, made to gear by cranks, or their equivalents, with the several paddles, for simultaneously changing the latter from an oblique to a straight set, and vice-versa. 6th, The combination with the cross sliding frame to the reciprocating truck, of one or more adjustable inclines and stops for automatically reversing the position of the paddles in their own direction. 7th, Drawing the cross frame back to its original position, to give to the paddles a different set, by means of a clip-lever, acted on by a weight, weighted catch, and inclined projection, connected with the reciprocating truck, or their equivalents, also afterwards returning said lever to its former position to be locked by the weighted catch by an inclined plane on the truck, acting against and over a swell on the lever. 8th, Varying the range of motion of the reciprocating truck on or over the drying surface, and relatively to the feed or delivering ends thereof, by means of a lengthening and shortening driving pitman, made adjustable.

135. Seed Planters; Andreas Maurer, New Carlisle, Indiana.

Claim—The arrangement and combination of the vertically-moving and seed-distributing supporting axle, and boxes, and lever, as set forth.

[The invention consists in having the axle of the supporting wheel extend through the sides of the frame of the machine, and below the seed boxes, the ends of said axle being provided with seed cells, and the axle allowed a certain degree of longitudinal play in its bearings, so that the seed cells may be shoved underneath the seed boxes or out from underneath them.]

136. Method of Combining Emery with Caoutchouc; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—Making emery sharpening and polishing tools by combining emery with india rubber, gutta percha, or other substances, and then submitting them while under great pressure to a high degree of artificial heat, whereby, with a given quantity of rubber, emery may be combined in much greater quantities than it could be heretofore done.

137. Harvesters; James McAleer, Chambersburg, Pennsylvania.

Claim—The arrangement of the two seats, one facing at right angles to the other, conducting trough, and binding table, and the elevating device, in the manner set forth.

138. Mode of Forming Joints in India Rubber Belting; J. McDougal, Masonville, Michigan.

Claim—The employment, in combination with the belt ends, of the tongues and cavities, so that the sides of the tongue portion shall be protected by the selvedges of the cavity parts.

139. Travelers Ticket-holder; S. T. McDougall, City of New York.

Claim—The lever, spring, point, or other equivalents, in combination with an ordinary shawl pin.

140. Skates; James P. McLean, City of New York.

Claim—The arrangement and use of the side or ankle springs, with parts, b b, and instep projections, adjustable or otherwise, in combination with the heel spring, having a pad at its top end, and with the cork sole in the form of a shoe, or otherwise. Also, the combined arrangement and use of the railroad attachment, as applied to a skate; the same forming a toe-strap loop if required, in the manner set forth.

141. Horse Power Locomotive; James C. Miller, Union Township, Pennsylvania.

Claim—Horse power sweep levers connected with one or more ground wheels.

142. Electro-magnetic Burglar Alarm; George F. Milliken, Somerville, Massachusetts.

Claim—The combination of a galvanic battery, an electric circuit, circuit-breaker, operated by a window or door, with a step by step indicator. Also, causing a window or door automatically to prevent any alteration upon the circuit during the closing of the window or door, until it is nearly closed, in any manner substantially as described. Also, the use of the armature for the double purpose of regulating the movements of the points and setting in motion the alarm apparatus.

143. Cultivators; B. S. Morgan, Delhi, Iowa.

Claim—The arrangement and combination of the side wings and wheels of a cultivator, with the levers, bar, rods, and hand lever, as specified.

144. Boot and Shoe Brush and Scraper; Wm. Morrison, Morrisiana, New York.

Claim—The arrangement of the springs, in combination with screws, in such a manner as to throw the brushes forward parallel with the scraper.

145. Hand Looms; Abel R. Nixon, Rhea Spring, Tennessee.

Claim—In combination with the lay beam and spring picker-staffs, the toggle-levers, b b, triggers, and flexible connexions, for effecting the setting and tripping of the picker-staff. Also, in combination with the lay and the treadles for working the harness or sheds, the toggle-levers, q, and trigger-cords, so that the shed shall be properly made before the trigger is drawn to let the shuttle fly, thus insuring a perfect sequency of operation, and with great saving of manual labor on the operator.

146. Varnish; Samuel Page, Chelsea, Massachusetts.

Claim—The described varnish, made of the materials specified.

147. Sole-cutting Machines; William Munroe, West Auburn, Maine.

Claim—1st, The arrangement of the vertical slots in the arbor, elastic bars, with their projections, fitting respectively in said slots; the weight, bar, and the shafts, provided respectively with the cam, spring, pinions, part pinion, and strap, to operate the arbor and its die or cutting flanch. 2d, The stop, attached to a shaft provided with springs, and actuated by the pin on the rod, and the notched block attached to the bar.

148. GEAR-CUTTING ENGINES; Henry Pfaner, City of New York.

Claim—A pattern mounted on a shaft or spindle, which also carries the gear to be cut, in combination with a fixed dog or guide, when said dog or guide is so located that the pattern runs off and is clear of the same, so as to be turned at the time the gear is clear of the cutter, and said pattern again takes and is held by said dog, as the cutting commences, and is proceeded with. Also, the arrangement of the lever, pawl, and adjustable stop, to give motion to the pattern when not in contact with the stop or dog. Also, in combination with the pattern and dog, the stock carrying the shaft or spindle, and actuated by the lever.

149. KEY-BOARDS FOR PIANO-FORTES; Mathieu Philippi, Troy, New York.

Claim—So constructing the upper surfaces of the keys of a piano-forte, that while the ordinary form of the key-board is retained, portions of all the keys are brought to the same level in the key-board.

150. HARVESTERS; Henry B. Ramsey, Indianapolis, Indiana.

Claim—The combination of the frames, chain, chain-wheel, crank, screw-rod, friction bearers, and grain table, arranged in the manner set forth.

151. LASTING-PINCERS; L. B. Richardson, Athol, Massachusetts.

Claim—The application of a swinging fulcrum to lasting-pincers, arranged in the manner set forth.

152. UMBRELLA FRAMES; Robert E. Rogers, Philadelphia, Pennsylvania.

Claim—Combining, with the tubular ribs and stretchers, the means for uniting the ribs and stretchers, and for strengthening the tubular parts of the frame, as set forth.

153. CULTIVATORS; William Seeley, Chillicothe, Illinois.

Claim—The arrangement of the post, arms, cross-bar, lever, wheel, shovels, chains, arms, cross-bar, vertical lever, rods, whiffle-tree, and draft hook, combined in the manner described.

154. MAKING SPOONS; Joseph Seymour, Syracuse, New York.

Claim—The machine known as the "rolls," having the former or figure of any article to be made up plain, of silver or other metal, cut upon one or both of them, so much larger than the same article when finished, that the article itself can be cut with a punch of the desired size and shape, out of a piece of metal after it has been passed between the rolls, and entirely within the margin or edge of the impression made upon the metal by the form or figure cut into one or both of the rolls.

155. INVALID BEDSTEAD; H. O. Sheidley, Republic, Ohio.

Claim—The combination of the sliding hinged bottom with the crank shaft, cords, and attached levers, and the movable foot board.

156. CUTTING AND PANNING CAKES; John H. Shrote, Baltimore, Maryland.

Claim—The cutters, as constructed, or their equivalents, in combination with the pan and bottom board, for the pupose of facilitating the cutting and removing the cakes to the oven.

157. DEVICE FOR BRACING AND VENTILATING FENCE POSTS; Charles R. Smith, Haverhill, New Hampshire

Claim—1st, The peculiar construction and arrangement of the wire loop, in combination with one pair of braces, a post, and a sill. 2d, The grooved post and the grooved cleats, in combination with the lengthwise boards or slats.

158. GOVERNORS FOR STEAM AND OTHER ENGINES; A. D. Snow, Rochester, New York.

Claim—The use of collar, first, to control the passage of steam through the valve on starting the engine; secondly, to control the extreme downward movement of the valve by means of stops, so connected with the valve openings as to close them at either extreme of the movement. Also, locating the weight beneath, and partially entering the tube of the valve.

159. CUTTING AND ATTACHING LABELS; C. M. Spencer, Manchester, Connecticut.

Claim—The cutting and affixing labels upon spools by one or the same action of a machine as the dies, on the tubular cutters, follower, or their equivalents.

160. ADJUSTABLE RAILS FOR REPLACING CARS ON THE TRACK; Joseph Andrew Stephan, Lafayette, Indiana.

Claim—1st, The fish pieces clamped to the permanent rails, and elevated high enough above said rails to carry the flanches of the car to be replaced over them. 2d, In combination with an elevated temporary track, secured to, and high enough above the permanent track to carry over the flanches of the wheels, the sections, and their switches extending to each of the pairs of wheels of the car, said sections having all the elements of switches, frogs, and rails.

161. METHOD OF PREPARING BONES FOR FERTILIZING PURPOSES; David Stewart, Annapolis, Maryland.

Claim—The stratification of the bones with materials, animal, vegetable, and mineral, substantially in the order and upon the principles set forth, using the materials above designated, or their equivalents, whereby bones are reduced in a most economical manner to an available condition for manure, and a thorough compost obtained adapted to all the necessities of growing and fruiting plants without any mechanical labor other than that of stratifying, cutting down, and screening.

162. MILK SAFE; William H. Tambling, Berlin, Wisconsin.

Claim—The described safe, constructed with gauze wire sides and doors, and with shelves, which consist of longitudinal slats, to which are secured a series of wooden cross slats, which are made broad at their base and beveled to an edge at their tops.

163. WASHING MACHINE; William H. Tambling, Berlin, Wisconsin.

Claim—1st, The arrangement of their buckets in the four corners of the interior of the box, said buckets being made in a triangular form and open at one angle. 2d, The arrangement of the bars as provided with pins, and in the form represented, when used in connexion with the box and the buckets, as specified.

164. MAKING CYLINDRICAL STRIPS OF DOUGH IN THE MANUFACTURE OF CRACKERS; Francis C. Treadwell, Jr., City of New York, and Henry McCollum, Windham, Connecticut.

Claim—The method of forming the skin-covered strips from a sheet of previously smooth-rolled dough, by passing it between a pair of grooved rollers, arranged as described, with the groove separated by portions of the plane surface of the rollers.

165. APPARATUS FOR VENTILATING RAILROAD CARS; John G. Treadwell, Albany, New York.

Claim—The arrangement of the boxes, of the porous partitions, and the pipe, provided at its lower end with a sprinkler, used in connexion with the openings, in the manner specified.

166. GRAIN CLEANERS; Isaac Wait, Watertown, New York.

Claim—The combination of the separating sieves and the burr surfaced plates, by means of the vibrating lever, which gives a contrary motion to each at every revolution of the wheel or crank.

167. LOCOMOTIVE CROSS-CUT SAWING MACHINE; John Walker, Sunbury, Ohio.

Claim—1st, The arrangement of an upright steam engine on a truck frame, with a horizontal crank shaft and a vibrating saw. 2d, The employment of conical pulleys and shiftable bands, in combination with the other machinery and the engine which operates the saw, for the purpose of guiding the machine when moving from place to place.

168. CUTTING SCREW THREADS ON GAS PIPES; Caleb C. Walworth, Boston, Massachusetts.

Claim—The combination of two or more mandrels parallel, or nearly parallel, to each other, and arranged to carry cutting tools with two or more vises, arranged to revolve round a common centre. Also, the combination of two or more sets of mandrels, as above, with two or more sets of vises, as above, each set of mandrels arranged to operate in unison with its corresponding set of vises. Also, the combination of two or more series of vises, one beyond the other, and arranged to revolve about a common centre. Also, operating two or more vises, independently of each other or together, by one wrench, and by the means and in the manner specified.

169. BED-BOTTOM; Daniel Winder, Cincinnati, Ohio.

Claim—The combination of the rings and tension screw, operating in connexion with a radial bed-cord or webbing, in the manner set forth.

170. LIFE-PRESERVING BUOY; Oliver Evans Woods, Philadelphia, Pennsylvania.

Claim—A buoy arranged with two frames, stays, and cross braces, and with a valve or valves, and otherwise constructed and operated as described.

171. SEWING MACHINES; Francis G. Woodward, Worcester, Massachusetts.

Claim—The peculiar manner of working the looping hook by means of the wheel and the double joint, as specified.

172. BURNISHING MACHINE; Le Roy S. White, Waterbury, Connecticut.

Claim—1st. The arrangement of the burnisher or burnishers in a burnishing machine in a sliding gate, or its equivalent, carried by, and working perpendicularly to, a rectilinear reciprocating shaft, or its equivalent. 2d. Providing for the burnisher or burnishers employed on one side of the article to be furnished, in a so-applied gate, or its equivalent, such a movement independently of that or those employed on the opposite side, as to produce the greater movement that is necessary or desirable, for the reason explained, on the convex side of any article of curved form. 3d. Fitting a burnisher in a burnishing machine to a suitable holder, or its equivalent, in which it is permitted a free vibration, laterally, to the movement it makes in the burnishing operation.

173. MODE OF MANUFACTURING BARRELS, &c.; George W. Banker, Medford, Assignor to self and G. O. Carpenter, South Reading, Massachusetts.

Claim—The method described of securing the heads of casks, by means of the chamfer and shoulder. Also, a keg furnished with ears and a bale, as described.

174. SEWING MACHINES; Oliver D. Barrett, Assignor to self and Lears E. Smith, Cleveland, Ohio.

Claim—1st. The crank, consisting of the disc and pin, in combination with the pin in the pulley and hinge, whereby I am enabled to turn the machine up from the table designed for it to stand on, in order to adjust or thread the under needle, without unbanding the machine. 2d, Hinging the foot-holder to the head of the goose necks, in a position vertical to the feeding surface of the feeder. 3d, The foot-holder, constructed and hinged as set forth, in combination with the rod, spring, foot, and feeder.

175. BUSTLES; Thomas A. Earl, North Attleborough, Massachusetts, Assignor to self and Charles A. Durgin, City of New York.

Claim—The segment, supported in combination with the projecting strut, slide, and strip, constructed as set forth.

176. COMPOSITION FOR PREPARING GOLD AND SILVER ORES FOR AMALGAMATION; Wm. Gluyas, Assignor to self and Wm. H. O'Neill, San Francisco, California.

Claim—The mixture or composition described, used with pulverized ores or tailings, the whole being brought to a boiling heat and being constantly agitated, thereby preparing the precious metals for a more perfect amalgamation with quicksilver.

177. BURGLARS ALARM; Stoughton B. Holden, Woburn, Assignor to self and Parker Nichols, Reading, Mass.

Claim—The arrangement of the candle-carrier and its hammer upon the torpedo post or standard, the trigger lever, and the grate or friction plate.

178. STRAW-CUTTERS; John S. Lash, Carlisle, Assignors to self and Franklin Knauss, Allentown, Penna.

Claim—Forming the bed in sections, each being provided with a spring, and having the spiral beaters or followers provided with shoulders, to prevent the lateral movement of the straw or stalks in the feed-box, under the action of the beaters or followers.

179. METHOD OF PREVENTING DEPOSITION OF CARBON IN GAS RETORTS; Alfred Marsh, Assignor to John Q. Dudley, Detroit, Michigan.

Claim—The introduction into the retort, during the gas making process, of chlorate of potash, or other substance, which evolves oxygen when heated.

180. TOOL FOR CUTTING ROUND TENONS; Charles O'Bryan, Assignor to self and Joseph S. Haldeman, Salem, Ohio.

Claim—The combination of the hollow conical head, external nut, and plate, arranged for adjusting and holding, when adjusted, the bits or cutters, or their guides.

181. SOLUTION FOR THINNING LUBRICATING COMPOUND; Robert Patterson, Philadelphia, Pennsylvania, Assignor to Horace Vaughn, Providence, Rhode Island.

Claim—A thinning solution applicable to the reduction of the lubricating compound, described in the patent of Vaughn & Hutton, dated Aug. 2, 1859, made of the substances and applied in the manner specified.

182. PEN AND PENCIL-HOLDERS; Thomas D. Richardson, Assignor to W. Richardson, City of New York.

Claim—The arrangement and combination of the elongated tube with the handle and tubes, as and for the purpose described.

183. Regulator Valve for Steam Engines; Nathan C. Travis, Assignor to self, Nathan Johnson, and Richard Emerson, Alton, Illinois.

Claim—The arrangement and combination of the valve-box and casing, as described. 2d, The arrangement and combination of the screw socket, stem, rod, arm, groove, and band-wheel, so that by turning the band-wheel, the stem may be elevated and depressed irrespective of the rise and fall of the rod, and without rotating the latter.

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184. Adaptation of Wads to Shots and Shells; S. C. Abbott, Zanesville, Ohio.

Claim—In combination with a shot or shell, that receives its rotation by the action of the atmosphere in its flight, and which has an open funnel-shaped base, a similarly-shaped open wad or packing, that when expanded by the gas, shall impinge both upon the bore of the gun and the interior of the shot or shell.

185. Jacquard Machines; Avery Babbitt, Auburn, New York.

Claim—1st, Arranging two or more trap-boards in one frame, in such manner that when all the said trap-boards, so arranged, are lifted, for the purpose of opening the shed, all the untrapped knot cords may pass said trap-boards without obstruction, in combination with an ascending and descending suspension board. 2d, In combination with the Jacquard machine, I claim the device represented on the sides of the machine for working the journals, or parts of journals, consisting of the pin-wheel, shaft, hooks, y y, and the hooks, o o, and the dog. 3d, Dividing the journals commonly used in two or three ply Jacquard weaving machines, and working them in any required order.

186. Harvesters; E. Ball, Canton, Ohio.

Claim—1st, The hinged plate, constructed as specified, in combination with the finger bar and brace-plate. 2d, The combination of the coupling arm (swiveled only at the point of connexion with the main frame), in combination with hinged plate, hinged brace-plate, and guide-piece. 3d, The guide-piece, in combination with the brace-rod, hinged plate, brace-plate, coupling arm, and chain. 4th, The combination and relative arrangement of spur, with coupling arm and pitman. 5th, The combination of the hinged plate and adjusting screw with the slotted guide-piece, hinged brace-plate, and chain.

187. Steam Engines; Daniel Barnum, City of New York.

Claim—The method of constructing and combining adjustable cut-off cams and adjusting screws, and a revolving and sliding rock shaft, and of combining these with the means described, for working puppet valves in steam engines. Also, the method of constructing, or using, or adjusting the cut-off cams, for the purpose of enabling me to fix or to adjust the point at which the steam is to be cut off, during any portion of the stroke, whether it be done while the engine is in motion or at rest.

188. Construction of Vapor Lamp Burners; Wm. W. Batchelder, City of New York.

Claim—Modifying the flame under the retort, by means of the wires, or their equivalents, in such manner that the deposit of carbon shall be prevented, and the blue flame produced. Also, deriving the gas for heating the retort from the gas pipe after its commixture with air, and before it reaches the illuminating jet, by means of the aperture, as set forth.

189. Cheese Hoops; John Beach, DeRuyter, New York.

Claim—1st, A hoop, having a cross-cut or division at its periphery, and constructed to open or close, as described, when provided, on opposite sides of said division, with hood or eye-straps, united by a tie-band of oval configuration, or other similar shape, and serving, in connexion with the eye-straps, to open and close the hoop, and to hold the same, when expanded or contracted. 2d, Providing the oval tie-band to the hook or eye-straps of the opening and closing hoop, with a lever or handle, arranged to cross the oval band, at points intermediate to the intersections therewith of the transverse and conjugate axis of the band, and secured to the band on its one side, but projecting freely through it on the opposite side.

190. Operating Window Blinds; C. G. Bloomer, North Kingston, Rhode Island.

Claim—The segmental disc, or its equivalent, and the spring, or its equivalent, in combination with one of the slats of a blind, when arranged to operate in the manner described.

191. Steam Boiler; M. S. Bringier, New Orleans, Louisiana.

Claim—The arrangement of a series of horizontal tubes or pipes, connecting two cylindrical chambers or reservoirs of water and steam, in combination with the steam cylinder connecting the same chambers.

192. Smoking-tube; William M. Bryant, Washington City, D. C.

Claim—A tubular tobacco pipe, which contains the supply of tobacco within it, and is furnished with a spring and follower, or their equivalents, that force up the tobacco to the burning point or chamber as fast as it is consumed.

193. Churn; S. N. Campbell, Elgin, Illinois.

Claim—The arrangement and combination of the button, dasher rod, movable slats, pieces, and bar, as described.

194. Construction of Hydrants for Filtration; John H. Carter, Cincinnati, Ohio.

Claim—The cylindrical inner vessel within the case, and made removable, in combination with the receiver for receiving the sediment, and the cap for favoring the direction of the sediment downward, in the manner set forth.

195. Operating Gun Carriages; Asa L. Caswell, Lansingburgh, New York.

Claim—1st, Returning the gun up to the port-hole, after being discharged, by means of a roller and cords, or chains, operated by a lever, or its equivalent, arranged in the manner, and dispense with the use of gun tackle, as set forth. 2d, The manner described, or equivalently the same, for securing the gun and carriage in a fixed position upon the truck, so as to maintain a given range for any number of discharges.

196. Hem-folders; Leverett Clark, Monticello, New York.

Claim—The hem-folder, composed of a straight gauge and adjustable plate, and a bar, the whole combined as described, either arranged as shown in figs. 1, 3, and 4, or as in figs. 2, 5, and 6, and operating as described.

197. Method of Opening and Closing Gates; B. R. Cole, Geneva, New York.

Claim—The arrangement of the bar to the levers, at such points as to give their lower ends the same motion inward or outward at the same time, as set forth.

198. MACHINES FOR SAWING BEVELED CURVES; Jonathan Creager, Cincinnati, Ohio.

Claim—1st, The combination of the inclined rest with a crown saw, for the production of a crowning cylindrical segment. 2d, The combination of a rocking rest with a crown saw, for the manufacture of a cylindrical segment having oblique axes.

199. TRY-COCK FOR STEAM BOILERS; James Cumming, Boston, Massachusetts.

Claim—The combination with an ordinary try-cock of a straight hollow tube, moving vertically on axis, and which is also the indicator at its outer closed end, and extending through the end or side of the boiler, and at certain periods remaining elevated above the level of the water, but capable of being brought below the same whenever necessary.

200. FEED-WATER APPARATUS FOR STEAM BOILERS; Wm. P. Curry, Vincennes, Indiana.

Claim—The arrangement of the rods, or their equivalents, to operate in combination with the discs, or their equivalents, and with the float and stop valve.

201. OPERATING FIELD GATES; Andrew J. Curtis, Frankfort, Maine.

Claim—The improved arrangement of mechanism described, for opening and closing a gate, the same consisting of the lever and the connecting rods, applied to the said lever and the gate posts. And in combination therewith, I claim the peculiar arrangement of the block, the same operating in connexion with the lever, in the manner specified.

202. CONSTRUCTION OF EVAPORATING APPARATUS; J. B. Dagne, Ashley, Ohio.

Claim—The employment of the pan which is provided with two or more compartments, and situated over a furnace, when said pan is used in connexion with the slides and damper, combined and arranged in the manner set forth, for the purpose of forming a sugar evaporator.

203. SLEEPING CARS; John Danner, Canton, Ohio.

Claim—1st, The combination of the hinged false back with the permanent back, a, as set forth. 2d, Making each alternate back with a false back, in combination with making each alternate back shorter than the backs, a, and hinged to the seat, as set forth.

204. HARVESTERS; John Ebner and Frank Lenthy, Lancaster, Pennsylvania.

Claim—The arrangement of the three eccentrics and revolving shaft of the driving wheel, in combination with the rake-connecting mechanism, constructed in the manner described.

205. PLOUGHS; Daniel Eldred, Monmouth, Illinois.

Claim—The arrangement for joint operation of the share frames, axle, and coulter, as set forth.

[The invention consists in having two shares attached to movable or adjustable frames secured to one axle, and using an adjustable coulter and axle.

206. PLOUGHS; Gilmore Emery and Aaron C. Wilson, Newfield, Maine.

Claim—The arrangement of the various parts of the plough, when constructed as described.

207. PRUNING KNIVES; Frank P. Goodall, Deering, New Hampshire.

Claim—The combination of pruning knife and arm rest, arranged as specified.

208. MACHINES FOR CRUSHING QUARTZ; Merritt Goodman, Whitlocks, California.

Claim—A revolving mortar or stamping-bed, in combination with a hollow stamp and shaft, as described.

209. CLOTHES-RACK; Oliver C. Green, Dublin, Indiana.

Claim—The arrangement and combination of the centre posts, arms, and braces, operating in the manner set forth.

210. FIELD FENCES; Joel Haines, West Middleburgh, Ohio.

Claim—The peculiar construction of the braces so as to adapt them to the keys, when combined with a sill having one or more notches, so as to hold the fence perpendicular when the sill is inclined.

211. APPARATUS FOR PREVENTING HORSES FROM RUNNING AWAY; Wm. Hall, Indianapolis, Indiana.

Claim—The apparatus described, when constructed and operated in the manner described.

212. LIGHTNING-ROD; William Hall, Indianapolis, Indiana.

Claim—The construction of a lightning-rod presenting a great amount of conducting surface in a compact form, when the same is constructed in the manner set forth.

213. HARROWS; Samuel W. Hamsher, Decatur, Illinois.

Claim—The arrangement of the harrow frames, toothed roller, and hinged adjustable arms, as set forth.

214. RAILROAD BRAKES; Joseph Harris, Allegheny, Pennsylvania.

Claim—1st, The combination of the winding apparatus, the weight, lever, rod, bent lever, sliding ring, sleeve, anti-friction ring, conical centre-piece, collar, with friction plates and spring plates, also screws, arranged in the manner of operating a railroad brake. 2d, The combination of the pawl and spring with ratchet and drum, with short chains and rods, the arm with pulleys connected by chains, rods, or ropes, for applying and maintaining the strain of a railroad brake at the centre of each car. 3d, The combination of the rod with the long arm of the pawl and the cross lever, connecting the shaft of the bunter to pawl, for the purpose of setting the brakes free.

215. STEAM PLOUGHS; James Hawkins, Wilkins Township, Pennsylvania.

Claim—The arrangement of the frames, levers, caster wheels, drivers, crank shaft, cutter, toothed cylinders, levers, operating conjointly as set forth.

216. KNITTING MACHINES; Joseph Hollen, Fostoria, Pennsylvania.

Claim—The combination of a needle, the barb of which is pressed by its own spring into its own groove, with a thread-carrier to release the barb and lay the thread therein, and a supporting guide to sustain the needle, when arranged and operated in the manner described.

217. WATER-GAUGE FOR STEAM BOILERS; Francis A. Hoyt, Boston, Massachusetts.

Claim—The described arrangement of the steam whistle, its valve, conduit, and valve seat, relatively to the dry steam chamber and the operating lever of the float.

218. PACKING PISTON-RODS OF STEAM ENGINES; Thomas J. Hudson, Newbern, North Carolina.

Claim—The method of packing the glands, a a, and applying the gland, c, with the packing in d d.

219. Construction of Vapor Burners; William H. Hunt, Brooklyn, New York.

Claim—The combination, in a vapor burner, of a conic frustrum and draft holes, in combination with the orifice and damper, constructed and combined as specified.

220. Oil-cans; George P. Hunt, City of New York.

Claim—The arrangement of the valve with the point of the tube or spout, in combination with the extension of the point of the valve for operating it, by which arrangement, when the point of the valve is relieved from pressure, the further discharge of oil from within the tube is prevented.

221. Construction of Compound Blow-pipes; J. Burrows Hyde, Newark, New Jersey.

Claim—1st, The compound conical nozzle, constructed with the projecting tubes, as described, combined with the concentric elastic tubes. 2d, The receiving tubes with their projecting tubes, for attaching thereto the elastic tubes.

222. Corn Planters; A Kirlin, New Boston, Illinois.

Claim—The cam, spring arm, ratchet, and pawl, arranged as set forth and operated by the marker wheels, for giving motion to the rotary hopper bottoms, for planting the corn.

223. Construction of Gas Regulators; George H. Kitchen, City of New York.

Claim—The construction of the valve chamber, having the valve fitted within it, as described, with a series of recesses whose width increases in an upward direction, or an equivalent series of passages surrounding the valve, and having their area of opening increased by the ascent and diminished by the descent of the valve.

224. Seed Planters; Adam Klaus, Belleville, Illinois.

Claim—The valve, in combination with the sliding door, when the same are operated simultaneously with the seed slide.

[This seed planter is provided with covering shares and a cutter, that are so arranged that two small furrows are drawn on each side of the seed, leaving the latter a little elevated in the ground, so that it is protected against being drowned by heavy rains. The seed is deposited on the ground from a discharge tube, in the lower part of which one throw of seed is always kept in store, so that the regularity of the rows is not disturbed by the time which it takes for the seed to reach the ground. The dropping apparatus is also connected with a registering mechanism that serves to keep account of the number of hills planted during a certain time.]

225. Steering Apparatus; Jesse S. Lake, Smith's Landing, New Jersey.

Claim—The arrangement of catches, braces, collar, pin, in combination with the barrel, in the manner set forth.

226. Making Ornamental Chains; James Lancelott, South Providence, Rhode Island

Claim—1st, The employment or use of the fillings in the female die, q, when used in connexion with the traveling die, r, for the purpose of insuring the proper presentation of the blanks to the latter, and at the same time admitting of a proper cutting edge for the female die. 2d, The employment of a forming die, J, in connexion with a rotating or partially rotating die, r, arranged to insure, simultaneously with the process of swaging the blanks into the proper shaped links, the proper adjustment of the latter for interlocking of the same. 3d, The decreased diameter of the upper portion of the forming die, J, so as to insure the adhesion of the cap, cup, or link to it, and enable the said die to perform the double function of die and carrier, when said die, J, is used in connexion with the die, r, to operate conjointly. 4th, Constructing the die, r, with a rod, with or without shears or projections, and arranged as set forth. 5th, The clearer rod and collar, either or both, applied to the forming die, J, and arranged to operate in connexion with the die, r, and rod, as set forth. 6th, The clamps in connexion with the swage or clinching tool, or its equivalent, arranged to operate conjointly, as specified. 7th, The guide plate, in connexion with the swage or clinching tool, the former serving as a guide to the latter, and insuring its proper action. 8th, The swage or clinching tool, constructed as shown, to bend or clinch the arms of the links, and at the same time keep the arms of the uppermost link in proper position, so that the latter may readily receive the succeeding link.

227. Washing Machine; S. E. Lanphear and O. D. Barrett, Cleveland, Ohio.

Claim—Supporting the disc by its stem on the standard, as set forth.

228. Cotton-spinning Machinery; Evan Leigh, Manchester, England; patented in England, February 26, 1858.

Claim—1st, The construction of top rollers and spindles with the arrangement of one or more of the bosses loose revolving thereon. 2d, The application of a journal, or all kinds of shafting spindles, studs, or axles, having the bearing part of the shaft, spindle, or axle or stud larger in diameter than the part immediately outside the bearing. 3d, The rounding out or dishing the edges of the steps or bosses, in combination with the tapering of journals or axles, of all kinds, by which I obtain the action of capillary attraction, for the purpose set forth. 4th, The application of a top roller of a spinning machine to its spindle, in such a manner as to enable such top roller to rotate on the spindle, and to rock in a longitudinal direction, in order that it may properly adjust itself to the under roller, while the two may be in use.

229. Amalgamator; Frank Maxson, San Francisco, California.

Claim—The use of the eccentric revolving pan, constructed and operated as described, in connexion with the amalgamated plate, as specified. Also, the arrangement of the shaft, projection pin, with the slotted piece, and wood, whereby a more or less eccentric motion is imparted to the pan, as described.

230. Composition of Emery for Grinding and Polishing Tools; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—My new compound for emery-sharpening and polishing tools, the same being made by combining 15 lbs. of emery, 1 lb. of india rubber or gutta percha, and 5 oz. of sulphur.

231. Metallic Seals for Letters, &c.; C. A. McEvoy, Richmond, Virginia.

Claim—The use together, in the manner described, of the metallic concave discs, having sharp points projecting from their circumferences, as set forth.

232. Cultivators; Thomas McQuiston, Morning Sun, Ohio.

Claim—The described arrangement of the elevated axle, beam, brackets, and rods, constructed in the manner set forth.

233. Car Couplings; John H. Mears and George Cameron, Oshkosh, Wisconsin.

Claim—1st, The tongue, a, for retaining link, n, constructed and operating as described. 2d, The arrangement of yoke, lever, spring, and connecting rod, as described.

234. MOLE PLOUGH; Adam Miller, Mount Pleasant, Iowa.

Claim—The employment of the rod, in combination with the coulter provided with staples, and the mole provided with the hooks, for the purposes specified.

235. MOLE PLOUGH; John Morrison, De Witt, Illinois.

Claim—The draft chain, bar, loops, and the adjusting screw rods, or their equivalents, combined, arranged, and applied to the plough, as set forth.

236. MACHINE FOR MANUFACTURING BONNET AND CAP FRONTS, &c; W. H. Morrison, Nottingham, England.

Claim—The application, in apparatus or machinery of the character referred to, of bars or gauges, operated to move simultaneously towards the lace or other fabric. Also, the adaptation of plates, operating in manner explained.

237. COTTON GINS; Enoch Osgood, Boston, Massachusetts.

Claim—1st, The rollers, plates, and bands, arranged as set forth. 2d, The combination and arrangement in a cotton gin or wool burring machine, of the clearer, rollers, angular plates, bands, slotted arms or bars, pinion, and wheel, in the manner described.

238. CABINET CHAIR; Sewall Pearson, Boston, Massachusetts.

Claim—Arranging in a bureau, chair, or other piece of furniture, in combination with a perforated seat, and with a self-closing pot, a water tank, which forms the back for the seat, and which communicates with the pot by means of a spout.

239. POLISHING IRON; George J. Prentiss, Fall River, Massachusetts.

Claim—The polishing cup, having two handles, arranged as described, or in any other manner substantially the same.

240. TRUSSES FOR RELIEVING PILES; Hiram M. Smith, Richmond, Virginia.

Claim—As improvements in the construction of anti-hemorrhoidal pads: 1st, The manner of sustaining such pads by means of springs passing from the pad to the front of the patient, and in a spiral form along the groin to a point over the hip joint, in combination with the plan of sustaining the instrument by flexible fastenings attached above the hip joints, thus making the instrument self-adjusting and enabling the patient to exercise in any position without inconvenience. 2d, The manner of balancing the instrument by means of flexible fastenings attached over the hip joints, no matter how the arms of the pad may be varied.

241. TUBULAR CONNEXION OF BRIDGES; Joseph W. Sprague, Rochester, New York.

Claim—The described series of clutches, provided with bands, in combination with the tubular sections, for the purposes set forth.

242. COCKS; David H. Stickney, Cincinnati, Ohio.

Claim—The supplementary chamber and stationary stuffing-box, in combination with a hollow piston, having ingress apertures adapted to be placed on either side of the said stuffing-box, by the motion of the piston.

243. BUSTLES; A. J. Thompson, Malden, Massachusetts.

Claim—The combination of a spring bustle of a flat spring or springs, united at their ends, to form the perimeter of the bustle or its frame work, and spread or divided, to establish a base at their bearing surface or surfaces against the body of the wearer and spiral springs, of conical configuration, and arranged to form cross-ties to the flat springs with their bases resting against the base formed by the latter, and for action in concert with the latter, and unitedly.

244. PORTABLE CRAB FOR MOLE PLOUGHS; Elijah Thorn, Selma, Ohio.

Claim—The arrangement of the frame, as constructed with the boxes, which are attached to the rear of the frame, and with the axle and wheels, the several parts being connected together and used, not only for elevating the machine, but for guiding its rear and changing its position.

245. MANUFACTURE OF HOES; Eben C. Tuttle, Naugatuck, Connecticut.

Claim—The construction of a hoe, by securing the eye in the blade by two projecting swells or beads, constructed and fitted for use, as described.

246. NAVAL ARCHITECTURE; Benjamin F. Wells, Georgetown, D. C.

Claim—Deriving the lines of vessels of all kinds and dimensions, from sections of a circular spindle of any dimensions or proportions, as described.

247. CARPET-STRETCHER; William Wheeler, West Poultney, Vermont.

Claim—The stretcher, when provided with the notch and the heel points, for the purpose set forth.

248. HORIZONTAL WATER-WHEEL; J. T. Wilder, Greensburgh, Indiana.

Claim—1st, Constructing a water-wheel with two sets of involute buckets, whose capacity shall be in the relative proportion to each other, as specified. 2d, The combination, with a wheel such as has been described, of a casing provided with two channels of different capacities and with two gates, arranged as described.

249. THERMOSTATS; Charles A Wilson, Cincinnati, Ohio.

Claim—A tubular thermostat, forming a part of the steam or other passage to be regulated and adapted by means of the unequal expansion of the metals of which it is composed, to close the said passage by lateral deflexion.

250. BUSTLES; George W. Yerby, City of New York.

Claim—The bustle, in which the waistband has a back piece and a corset, or part corset, in front, provided with one, two, or more sets of pockets, into which the springs of the bustle are inserted, constructed in the manner described.

251. WEEDING-HOES; James M. Adams, Assignor to self and Alonzo Johnson, Canton, Massachusetts.

Claim—The arrangement of the two blades with the bifurcated handle, constructed in the manner set forth.

252. PRESERVE CANS; Benjamin L. Agnew, Assignor to G. P. Reed, Indiana, Pennsylvania.

Claim—The combination, in a preserve jar, of a deep outer flanch or rim, with a shallow inner flanch, in the manner described.

253. RODS OF WINDOW BLINDS; John G. Baker, Assignor to self and Asa L. Carrier, Washington City, D. C.

Claim—The peculiar construction of thin metallic tubes the two edges so forming the ears or rings, in combination with wire staples or rings, to connect wood slats for movable blinds.

254. BUSTLES; Barron Davis, Brooklyn, New York, Assignor to Osborn & Vincent, City of New York.

Claim—Attaching the hoops to the extension by fixed and immovable connexions, so that the hoops cannot be thrown forward or outward, when the hoops are connected to the band by means of the cross-bands, in combination with the back point or extension.

255. METHOD OF MAKING GAS FROM PEAT; J. Burrows Hyde, Assignor to Phebe Bamman, Newark, N. J.

Claim—1st, Exposing such peaty matter to thorough desiccation by artificial heat, and conveying it to the retort without permitting it to absorb moisture from the air. 2d, Granulating or powdering such peaty matter, distilling and cooling it in closed cases. 3d, Employing the heat evolved in cooling the carbonized material to aid in desiccating the peaty matter.

256. MACHINE FOR COVERING SADDLE-TREES; John Maclure, Assignor to self, Samuel E. Tompkins, and Samuel C. Northrup, Newark, New Jersey.

Claim—The employment of an elastic bed or cushion, in combination with the cover and seat, as described. Also, the arrangement and combination of the box, adjustable sliding bars, elastic cushion, seat, clamp, and pressing lever, as described.

257. CLOTHES FRAME; S. W. and J. F. Palmer, Assignors to S. W. Palmer, N. Palmer, and John Patty, Auburn, New York.

Claim—Hinging the arms of a clothes frame to the sliding hubs by means of the pins, which are supported by the open lugs, arranged in the manner described. Also, in combination with the shaft and its grooves, the sliding catch-ring with its spring and projection, for retaining the frame in its position. Also, in combination with the central post or shaft and sliding frame, the hoisting apparatus, consisting of the clutch-rings, with their springs, lever, and link.

258. FANCY LOOMS; Conrad Roder, Assignor to self and J. F. Iler, Ceralvo, Kentucky.

Claim—The combination and arrangement of the double catch-hooks, adjustable guide plate, the sash, with the lifting bar, in the manner described.

259. CLASP FOR SKELETON SKIRTS; Wm. Daniel Sloan, Assignor to A. B. Chapman, City of New York.

Claim—The clasp for uniting the tapes or galloons to the hoops in skeleton skirts, said clasp being formed with a narrow ribbed or V-shape back piece.

260. PADDLE-WHEEL; James Speers, West Manchester, Assignor to self, Alexander Postley, and John Webbe, Allegheny County, Pennsylvania.

Claim—The arrangement of the flanches, the arms with points, the braces, and floats, when used for the purpose of constructing a propeller.

261. BANJOS; Stephen F. Van Hagen, Assignor to George Kilbourne, Albany, New York.

Claim—The combination, in one instrument, of the banjo parchment-covered open body, with the neck and fretted finger-board of the guitar, the thumb-string of the banjo being added to the usual strings of the guitar. Also, the formation of the front part of the body of the instrument, of an acute, oval or lancet form, in the manner set forth.

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262. MOULDING PLOUGHS; B. F. Avery, Louisville, Kentucky.

Claim—The peculiar construction of the patterns of the short land-side, so that they may be drawn at opposite angles from each other, for the purpose and in the manner specified.

263. BRONZING MACHINE; G. H. Babcock, Westerly, Rhode Island.

Claim—1st, In combination with mechanism for conveying the sheet, the use of rubbing cylinder and brush, one or more of each, for the purposes and in the manner described. 2d, The use of one or more stationary rubbers, or their equivalents, for the purposes specified. 3d, The wires, or their equivalents, for freeing the brush from the powder. 4th, Constructing the gripper, in the manner described, whereby I obtain the advantages set forth. 5th, Enclosing the rubbing and brushing cylinders in a case, for the purpose of retaining the powder and preventing waste.

264. DITCHING MACHINES; J. W. Barcroft, Friendship, Virginia.

Claim—1st, The combination of a revolving wheel, having its buckets or scoops set tangentially with a stationary circular guard, and an adjustable scraper. 2d, Having the buckets or scoops hung on an axis at the centre of their length, and adjustable at both ends, as set forth. 3d, Providing sharp cutters, projecting at right angles from the centre of the scoop, as set forth.

265. SEWING MACHINES; Wm. T. Barnes, Buffalo, New York.

Claim—The arrangement of the threaded elastic looper, as constructed, with a receiving and transferring spring, when the two are secured on opposite sides of the needle, and operated to and from the needle by means of levers, connecting rods, and frames, combined as set forth.

266. COAL-SIFTERS; Mellen Battel, Albany, New York.

Claim—The stationary ploughs, and brushes, and ribbons, in combination with the horizontal revolving sieve, as set forth.

267. APPARATUS FOR OPERATING RUDDERS; C. F. E. Blaich, Elyria, Ohio.

Claim—The combination of the rudder, spiral ribs, and spirally grooved sliding tube, in the manner set forth.

268. METHOD OF ELEVATING WATER; C. C. Bomberger, West Carlisle, Pennsylvania.

Claim—The arrangement of the air-tight boxes, connected by the pipe, G, and communicating respectively with the pipes, A D, in connexion with the open vessel, tube, H, and the valves placed to the tube, H, and pipe, P, and operated automatically as shown.

269. MECHANISM FOR CONVERTING ROTARY INTO RECIPROCATING MOTION; W. N. Brown, City of New York.

Claim—The rock shaft having a hollow hub, in combination with the oblong ring and rotating cam, operating in the manner set forth.

270. FLOATING SAFETY CABIN; M. J. Butler, Nashville, Tennessee.

Claim—The arrangement of the detached boat-shaped cabin, gate propeller, jointed hinged straps, wedge, rudder, windlass, ordinary vessel, valve, passage, and stairs, in the manner set forth.

271. SURF LIFE-BOAT; M. M. Camp, New Haven, Connecticut.

Claim—1st, The combination of the water ballast chamber with the aperture and air-pipe, for the purpose of ballasting the boat when she enters the water, and of lightening it when she touches and reaches the shore. 2d, The combination of the valve with the ballast chamber and aperture. 3d, The combination of the floors, for the purpose of forming the air chamber beneath the working floor, and between the two floors. 4th, The combination of the divisions with the working floor, to form receptacles between said divisions and the sides of the boat.

272. CONSTRUCTION OF GLASS COFFINS; J. R. Cannon, New Albany, Indiana.

Claim—Constructing a coffin of glass, the body of which is provided with a groove, and the lid with a flanch and a pump, the lid being secured to the body by means of metallic bands.

273. MACHINES FOR BOLTING FLOUR, &c.; M. H. Collins, Chelsea, Massachusetts.

Claim—1st, A curved frame, in which are placed one or more bolting sieves, this frame being open at each end for the discharge of bran or other coarse material. 2d, The combination with the curved frame and sieves of a corrugated rubber, the frame and sieves having a vibrating motion in the path of a circle, while the rubber remains stationary. 3d, The arrangement of sieves of different sized meshes, and having the same vibrating motion on the circular vibrating frame, and in the relation shown to a fan-wheel, which causes a draft at the back of the machine.

274. SEWING MACHINES; C. O. Crosby, New Haven, Connecticut.

Claim—1st, The rotary bobbin case, armed with the inclined loop spreader, and supporting on a pin, in its centre, the bobbin, which holds one of the threads in combination with the loop detainer. 2d, The method of detaining the loop of the needle thread after the loop has passed the full diameter of the bobbin case, by the projection and inclined plane terminating in a point on the buffer. 3d, The frame or form, composed of the curved bar, o, bar, R, and foot, in combination with the bolt, elbow-shaped lever (carrying the pieces, g), and friction cap, arranged to feed the material.

275. CENTERING MACHINES; James Cumming, Boston, Massachusetts.

Claim—1st, The arrangement of the notched interlocking slides, right and left screws, pinions, shaft, bed-plate, and upright drill, operating in the manner described. 2d, The combination of the drill arbor, hollow swivel oiling cap, and independently rising and falling rod, and disc, attached in the manner described.

276. WASHING MACHINE; R. C. Cyphers, Milledgeville, Georgia.

Claim—1st, The arrangement of the elastic suspended concave, with slats pivoted to elastic strips, in combination with the jointed spring rubber, as described. 2d, In combination with the jointed spring rubber, the employment of a flexible band or rope, for the purpose of securing the clothes to the rubber. 3d, The arrangement of the central shaft, in combination with the elastic suspended concave and grooves.

277. HARVESTERS; Horace L. Emery, Albany, New York.

Claim—1st, Combining with the cutter bar an adjustable arm or lever, provided with a roller, or other means of sliding easily upon the ground, for the purpose of sustaining the cutter bar at any required distance from the ground, or allowing it to rest upon the ground at pleasure. 2d, Placing the said arm directly in rear of the shoe, in order that it may be prevented by said shoe from clogging. 3d, Connecting said arm by a rod along the back of the cutter bar with a lever near the frame of the machine, so that the attendant may elevate and depress the cutter bar at pleasure.

278. SEED PLANTERS; George M. Evans, Pittsburgh, Pennsylvania.

Claim—The combination and arrangement of the seed drums, elevators on the belt, with the compartments of the hopper, the cranks, the connecting rods, the ratchet wheels, and the wheel, as described.

279. COFFEE-POTS; H. B. Fay, City of New York.

Claim—The arrangement of the tube, in combination with the adjustable double-strainer, that is arranged in a pot between the spout and the liquid, as described.

280. STUDS AND SLEEVE-FASTENERS; Felix A. Finn, City of New York.

Claim—The swivel bar and arm, arranged as specified. Also, in combination therewith, the dovetail stud, to confine the front end of the arm when closed upon it. Also, the projecting screw, against which the spring acts. Also, in combination with the above devices, the spring, constructed as set forth.

281. AUTOMATIC FAN; Frederick O. Degener, City of New York.

Claim—The arrangement and combination of a rotary fan-blower, with the hollow vibrating or distributing fan, for the purpose of producing a current of air and causing it to be distributed, as specified.

282. VALVES FOR STOVES, FURNACES, &c.; B. Wells Dunklee, Boston, Massachusetts.

Claim—The side plates, projecting from and connected with the hoe valve, as related to each other, and in respect to the openings and flue, in manner described.

283. PRESERVE CANS; Wm. Fridley and Frederick Cornman, Carlisle, Pennsylvania.

Claim—The employment of a perforated cover, in combination with the gasket and mouth, so that the gasket constitutes virtually a portion of the cover of, and an index to, the condition of the contents of the vessel.

284. MACHINE FOR CLEANING AND OPENING FLOCK; W. C. Geer, Rockville, Connecticut.

Claim—The employment or use of a revolving cone or cylinder, provided with toothed lugs, and placed within a correspondingly shaped toothed shell, in combination with the toothed cylinder, concave, and fan, arranged as set forth.

285. IMPLEMENT FOR BORING EARTH; Daniel Gordon, Evansville, Indiana.

Claim—Arranging the blades on the convex surface of the bottom of the auger, and extending the cut beyond the periphery. Also, arranging the valves in the concave sides of the bottom of the auger, as set forth.

286. MACHINERY FOR CLEANING COTTON; Daniel Hess, West Union, Iowa.

Claim—1st, The curved metallic division, in combination with the front rollers and the bolting cloth, in the manner set forth. 2d, The combination of the fan and case with the back rollers and the bolting cloth, for the purpose of cleansing the cloth from fibres of cotton.

287. PUMPS; Silas Hewitt, Seneca Falls, New York.

Claim—The plunger or bucket, constructed in the manner set forth.

288. DITCHING AND GRADING MACHINES; Isaac Hoskins, Wilmington, Ohio.

Claim—Making the side wheel adjustable so as to raise and lower the side of the frame, to level or adjust it as desired. Also, a bell made of bars, with projections or flanches at each end, arranged to travel under cleats on the sides of the frame or trough.

289. DOOR LATCH AND LOCK; Anthony Iske and Jacob Teufel, Lancaster, Pennsylvania.

Claim—The arrangement and combination of the curved swivel lever, bolt, with its peg and projecting end, to answer both for turning, pulling, and pushing together, with the revolving lever for operating the lock.

290. FURNACES FOR STEAM BOILERS; Edward H. Jones, Albany, and Robert Stevenson, Schenectady, N. Y.

Claim—The arrangement of the hopper-shaped grate-box, so constructed as to be adjustable in height, combined with the grates, having means attached for rocking or agitating them, in their relation to each other and to the boiler fire-box, in the manner set forth.

291. MOLE PLOUGH; S. F. Jones, St. Paul, Indiana.

Claim—1st, The employment of the ball, not generally, but when said ball is secured in such a manner upon the top of the rear of the mole, that it will revolve when the mole is in motion, for the purpose of arching the top of the drain and closing the opening of the coulter. 2d. The combination of the nose, mole, ball, rod, and wheel, when the same are used for the purpose of forming and arching the drain and closing the opening of the coulter.

292. MOVING TREAD POWER; Louis Koch, City of New York.

Claim—1st, The described mechanism, or its equivalent, when operated by the feet of man or animal, in stepping on the ends of bands or cords during the act of walking. 2d. Using the weight of man or animal in stepping on bands, or their equivalent, as a cause of resistance against the propelling of the machine, and giving motion by the walking of said man or animal to said mechanism, or its equivalent, independently of the motion of the wheels on which the whole mechanism is supported.

293. COTTON PRESSES; Charles N. Lovejoy, Columbia, South Carolina.

Claim—The guides for guiding the chains upon fusee wheels, and the follower, block, and windlasses, arranged in the manner as described, when combined with the cotton box and its operative parts, in the manner described.

294. SKIRT-SUPPORTERS; John McNeven, Brooklyn, New York.

Claim—The dress-supporter, consisting of a hoop and stiffeners branching off from said hoop, the wristband, and tapes, arranged and applied to the body in the manner described.

295. DOORS FOR IRON SAFES; L. H. Miller, Baltimore, Maryland.

Claim—The combination of the tongue, grooved flanches, V-shaped mouldings, and V-shaped grooves, in the construction of a fire-proof safe or bank vault, in the manner described.

296. APPARATUS FOR GENERATING STEAM; Thomas Moore, Minneapolis, Minnesota.

Claim—The employment, in combination with a steam engine, or other apparatus in which steam is used, and the boiler which supplies it, of a system or arrangement of one or more condensers and heaters, with connecting pipes and a tank, whereby the exhaust steam, after passing along a pipe running through the boiler itself, is condensed by delivering up its remaining latent heat to water, which, after having been previously condensed in the same manner, is on its way back to the boiler, and whereby the water obtained by the condensation of the exhaust steam is heated on its way back to the boiler, and partly converted into steam again by the combined agencies of the latent heat it absorbs from the escaping steam, and by the heat it absorbs from the escaping waste production of combustion, as described.

297. WIND-MILLS; James W. Neff, Sacramento, California.

Claim—The arrangement of the sails, arms, or spokes, and hub, and placing them in rear of the spiral spring and flanch, and connecting the flanch with sails by rods, as described.

298. COFFEE-POTS; George Neilson, Boston, Massachusetts.

Claim—The reversible cafetiere, as composed of boiler, the filtering biggin, the foraminous cup or strainer, and the condenser or coffee-pot, having a spout and cap, arranged in manner explained. Also, the combination of the air and tell-tale pipe with the boiling vessel, the condensing vessel, the biggin, and the strainer or cup.

299. NAIL MACHINES; Adrian V. B. Orr, Lancaster, Pennsylvania.

Claim—1st, Combining, in a single pair of dies, constructed as described, the operations of cutting, pressing, and gripping the nails or spike. 2d, The slide point, operating in combination with the slide, arranged as specified.

300. CAR BRAKES; George F. Outten, Norfolk, Virginia.

Claim—The combination and arrangement of slide, pawl, spring, a, ratchet wheels, and chain, levers, and spring, h, operating automatically or by hand, as may be desired.

301. APPARATUS FOR RAISING WATER FROM WELLS, &c.; Elhanan Puffer, Oxford, New York.

Claim—Producing and controlling the movements of the windlass roller upon and with its actuating shaft, in such a manner as to prevent the necessity of ever imparting a reverse rotary movement to the windlass shaft whilst operating said apparatus, and by means substantially the same as those described. Also, combining the valve which closes the discharging aperture in the bottom of the bucket, with the inner end of the lever, which is pivoted to the after edge of the mouth of said bucket, when a rod, or the equivalent of the same, is so situated within the curb as to be taken hold of by the hook-shaped outer end of said lever, just before the bucket reaches its highest position, for the purpose of causing the further upward movement of said bucket to throw forward its bottom and discharge its contents.

302. SEWING MACHINES; T. J. W. Robertson, City of New York.

Claim—The arrangement and combination of the carrier, spring plug, and vibrating arm, as described.

303. CHURN-DASHER; Alfred Rose, Penn Yan, New York.

Claim—The churn-dasher, when made in the manner substantially as set forth,

304. DISENGAGING HOOK; Albert W. Roberts, Hartford, Connecticut.

Claim—A hook, consisting of a hook link with bearer on its side, in combination with the jointed ring, lever, crank pin, and collar, as described.

305. Mills for Crushing Sugar-cane; F. M. Robinson, Conneautville, Pennsylvania.

Claim—The combination of the flanched journal-boxes with the flanched sockets, in connexion with the flanches of the above parts.

306. Reefing Fore-and-aft Sails; Samuel Samuels, Brooklyn, New York.

Claim—Supporting the rolling boom in two bearings, one of which is in a truss connected with the mast by a hoop or its equivalent, and the other in a ring, which is held by the lift and braces. Also, the combination, with the rolling boom, of the gypsy-purchase, applied as described.

307. Sewing Machines; Irwin B. Sawyer and T. Alsop, Springfield, Illinois.

Claim—The use of the hook, formed and moving as described, combined with the shuttle and needle.

308. Piano-forte Action; Thomas S. Seabury, Stony Brook, New York, Assignor to R. B. Gorsuch, City of New York.

Claim—1st, Pivoting the hammer-butt to a post, or its equivalent, carried by its respective key, for the purpose of enabling it to be withdrawn from the instrument along with the key. 2d, The suspended jack or fly-lever, attached to the hammer-butt, and provided with a notch, operating in combination with stationary rail. 3d, The arrangement of the regulating screw in the suspended jack or fly-lever, in combination with the inclined plane on the post erected upon the key, to carry the hammer—but I wish to be understood as not claiming, generally, either the placing of the regulating screw in the jack, or the employment of an inclined plane or wedge, to act in combination with an inclined or wedge-like surface. 4th, The check, applied to the bottom of the key, and operating in combination with the suspended jack or fly-lever.

309. Carriages; Isaac M. Singer, City of New York.

Claim—The arrangement, in the main body of the carriage, of the low seats, in combination with the elevated seats, arranged in manner described. Also, in combination with the back, depressed and elevated seats, as described, the arrangement of the hinged partition to answer the three-fold purpose of a step to get to the elevated back seats, and back to the middle depressed seat, and to separate the feet of persons sitting on the elevated seats from the persons sitting on the depressed seats. Also, in combination with the front elevated seats, as described, the arrangement of hinged step leading to the elevated seats, together with its dirt-flap, for the three-fold purpose of a step to the elevated seats, a dirt protector, and of a seat in case of necessity. Also, the arrangement of the boot for baggage in the space between the bottom and the front elevated seats, with doors at the sides, thus placing the weight below, and concentrating it on the front axle. Also, the combination with the main body of the carriage, the placing the coupe at the rear thereof, and communicating therewith by a door-way through the back. Also, depressing the coupe at the back of the main body, that the bottom of both may extend below and leave the required open space for the rear axle and its connexions; and that the top of the coupe may form a foot-board to the seats, at the back edge of the main body. Also, in combination with the coupe, the open spaces under the back elevated seats of the main body opening into the coupe.

310. Thrust-bearings for Rotary Shafts; George A. Stone, Roxbury, Massachusetts.

Claim—1st, The combination of these four things, namely, a collar or collars on the shaft; washers provided with grooves on their faces, extending from their outer to their inner edges, as described; a reservoir of oil or other lubricating material; and a pillow block or stationary resistance. 2d, In combination with washers provided with grooves on their faces, a reservoir of lubricating material, a pillow block, or its equivalent, and a collar on a shaft, all as specified in my first claim, I claim grooves extending from face to face of the washers, in the manner described.

311. Grain Separators; F. Swift, Hudson, Michigan.

Claim—The employment or use of a supplemental shoe, c, placed within the shoe, B, provided with screws, and having an independent longitudinal shake movement given it, while the shoe, B, with its screws, has the usual lateral shake movement imparted to it.

312. Keys for Locks; Peter Van Antwerp, City of New York.

Claim—Constructing the stems of keys with a hole near the end, instead of the usual permanent bow or ring handle, and to be fitted loosely to the usual ring for connecting a series of keys, and in such manner as described, that said connecting ring shall answer the further purpose of the usual bow or fixed ring for turning the keys when inserted in the lock.

313. Spring Bed; John L. Whipple, Detroit, Michigan.

Claim—The general arrangement of the seat, spring, and the strap, in the form described, and combined for the purpose in the position as set forth.

314. Field Fences; John L. Wentworth, Spread Eagle, Pennsylvania.

Claim—Constructing each section of a fence of the two end posts, upper and lower longitudinal rails, any suitable number of intermediate rails, E and F, and the vertical bar, arranged in respect to, and adapted to each other, as set forth.

315. Breech-loading Fire Arms; Franklin Wesson and Nathan S. Harrington, Worcester, Massachusetts.

Claim—1st, The combination of the mechanism for locking and unlocking the barrel, and the arrangement of the trigger, as described. 2d, The combination, with the locking and unlocking mechanism, of the spring, arranged as described, for elevating the breech. 3d, In combination with the barrel, the wedge-shaped recess in the recoil plate, arranged as described.

316. Portable Shelves; J. S. Voorhies, Catlettsburg, Kentucky.

Claim—Constructing portable box-shelving for stoves, book-cases, and all similar purposes, in the manner described.

317. Shirt-studs; Dutee Wilcox, Providence, Rhode Island.

Claim—The described mode of making a shirt-stud or button, viz: of the two parts or plates, and the two hooks or curved holders, arranged in the manner described.

318. Cannon; Joseph Adams, Assignor to self and B. Barker, Cleveland, Ohio.

Claim—The use and application of a piston for the purpose of loading, cleaning, and cooling a cannon, the stem or end of which passes through the breech or rear end of the gun, and is attached to a head or metallic piston, the circumference of which is equal to that of the bore of the cannon, and is made to fit the same exactly, and which piston-head, when drawn back, rests upon the main shoulder or substance of the breech at the point where the rod connects therewith, and is of sufficient length to cover and serve as a valve to close the lateral opening at the breech end of the cannon, through which water is admitted to fill the bore of the

gun when said piston is forced forward towards the muzzle, and which piston plays forward and backward, the entire length of the bore of the gun, so as to protrude sufficiently at the muzzle when forced forward, thus carrying out any substance of the exhausted cartridge after firing, and to which piston-head or bulb the new cartridge is attached and drawn back to the breech or butt of the gun by the force applied to said rod, and in which condition the gun is loaded and ready to be again discharged. Also, the construction and employment of a lateral opening from the main chamber or bore of the gun, either passing through the breech-pin or otherwise, at or near the rear end thereof, and where the same will be closed and covered by the piston-head, when the same is fully drawn back into (or by means of a tube or pipe connecting with a water-sack or vessel), and by means of which arrangement water is admitted and drawn into the gun by the same force which carries the piston forward to receive the charge at the muzzle, and is returned to the vessel again by the same force which carries in the charge, thus washing and cooling the gun at every discharge, without any other movement than that necessarily employed in the act of loading alone.

319. Mode of Feeding-in Fuel to the Fire-boxes of Cooking Stoves; M. C. Cronk, Assignor to self, William Boynton, Jr., and Albert H. Goss, Auburn, New York.

Claim—1st, In combination with the stationary upper fire-box, a rocking or swinging fire-box underneath it, having a flanch or cut-off connected thereto. 2d, In combination with the rocking or swinging fire-box and cut-off, a rising and falling grate. 3d, In combination with the rocking or swinging fire-box and rising and falling grate, a single rod or shaft, with its cams for operating both.

320. Stoves; L. W. C. Farrington, Lowell, Assignor to Tuttle & Mudge, Boston, Massachusetts.

Claim—A parlor stove, having an oven, which is opened by raising the top, in the manner set forth.

321. Razor-strops; Charles Younglove Haynes, Assignor to C. Y. Haynes & Co., Philadelphia, Pennsylvania.

Claim—The strop, constructed in the manner described.

322. Amalgamator; W. H. Howland, Assignor to self and John O. Hanson, San Francisco, California.

Claim—The combination of a pair of grinding cones, revolving in different directions, with a horizontally-oscillating chambered dish, as described.

323. Watches; Joseph Ives, Bristol, Connecticut.

Claim—1st, The combination of the spring, lever, and cam, in the manner described. 2d, The substitution of ribbed, corrugated, planished or unplanished tin plate for running gear, &c. (for other metal), when used in combination with the rolling pinion, as described. 3d, Making a crown-wheel with rollers instead of teeth, to prevent slide and friction upon the verge or pallet, in the manner described.

324. Composition for Mixing with Paints; George W. Slagle, Assignor to self and O. A. Dailey, Washington City, D. C.

Claim—Making melaniline oil, or a substitute for linseed oil, by mixing together linseed oil, or other vegetable oil possessing similar qualities, water, and sal-soda, or other similar suitable alkali, in the manner set forth.

Extensions.

1. Barrel Machinery; Wm. Trapp, Jr., Dryden, New York; re-issued October 1, 1845; re-re-issued March 10, 1849; extended October 4, 1859.

Claim—1st, The combination of the slide rest guided in the manner set forth, with the tool for turning off the cask. 2d, The apparatus for chamfering, and howelling, and crozing—that is to say, the combination of the cylinder, open at both ends, so that both ends of the cask can be worked off without changing, with the ring-chucks for fastening the cask into the cylinder, and with the tools as described, for chamfering and howelling. 3d, The crozing-tool with the changeable face-plate. 4th, The combination of the stock, cutter, adjustable and gauge plate, constituting the tool for turning and smoothing the outside of the cask. 5th, The peculiar construction of the tool for howelling the cask, as described. 6th, The peculiar construction of the tool for chamfering the ends of the cask, as described. 7th, The mode of edging and jointing bilge staves, for making barrels and other bilge work, by the employment of a swing frame having a concave or convex bed in or against which the staves are sprung and secured to the required bilge, in combination with the revolving edging-saw and reciprocating straight-jointer, or either, whether the said swing frame for confining the stave in its bent position, and conveying it to the edging-saw and straight-jointer, be constructed in the manner set forth, or in any other manner that may be substantially the same.

2. Ruling Machines; Lewis Edwards, Norwich, Connecticut; patented October 9, 1845; extended October 11, 1859.

Claim—Causing the pens to be raised by the edge of the paper in its passage through the machine, thus causing each sheet to determine the length of its own lines.

3. Cultivator Teeth; David B. Rogers, Pittsburgh, Pennsylvania; patented Nov. 1, 1845; re-issued Sept. 20, 1859; extended October 25, 1859.

Claim—Making the shank or upper part of cultivator teeth of thin plate steel, U-shaped or curved round in front, substantially as described, for the purpose of securing the necessary strength to permit the tooth to be made entire, shank and blade, of a single piece of metal, and also enabling the tooth to be secured in its place in the band by means of a wedge driven into the cavity of the shank.

Additional Improvements.

1. Corn Planters; Alexander, William, and James Campbell, Harrison, Ohio; patented June 28, 1859; additional dated October 4, 1859.

Claim—1st, The described arrangement of the weighted valve, rod, tappet, wheel, slides, and tube, for the purpose set forth. 2d, In the described combination with a cam wheel, crank shaft, rod, and rocking lever, we claim the inverted arch yoke, constructed as set forth.

2. Tobacco Presses; Wm. R. Musser and J. Coleman, Lynchburg, Virginia; patented February 2, 1858; additional dated October 4, 1859.

Claim—1st, The top plate of the press in connexion with the bottom plate of said press, used for retaining pressure and forming the bed of the main truck. 2d, The groove nuts for raising and lowering the top plate of the press, without taking it from the bars.

3. ATTACHING THILLS TO VEHICLES; Douglas Bly, Rochester, New York; patented April 12, 1859; additional dated October 11, 1859.

Claim—Combining with the hook a collar, having a reverse hook or lip corresponding with the point to form an eye therewith, together with the screw shank and binding nut, as specified.

4. CURTAIN FIXTURES; Joseph F. Hall, Bangor, Maine; patented March 9, 1858; additional dated October 25, 1859.

Claim—The application of the lever, as explained, in combination with the cord and tassel, with the pulley or eye in the end of the tassel, as described.

RE-ISSUES.

1. FLOUR-BOLTS; James M. Clark, Philadelphia, Pennsylvania; patented July 26, 1859; re-issued October 4, 1859.

Claim—1st, The slide valve or valves, arranged and operating with the apertures in the sides of the bolting chest, so that either of the apertures can be opened or closed, or both closed when required, for the purpose of turning the material as desired in either of these directions. 2d, In combination with these valves, the concave and scrapers upon the bolt, arranged as set forth.

2. MACHINES FOR BURNISHING METALS; Jeremiah Stever, Bristol, Connecticut; patented May 1, 1855; re-issued October 11, 1859.

Claim—The burnishing of silver-plated and other metallic ware, such as spoons, knives, and forks, or other similar articles which have a concave, convex, or other bevel surface, by an organized machine, requiring no other attention than being kept in proper order, adjusted to suit the article about being burnished, set in motion, and having the articles properly introduced to it successively, in the manner set forth.

3. FURNACE FOR SMELTING IRON; Squire M. Fales, Baltimore, Maryland; patented February 8, 1859; re-issued October 18, 1859.

Claim—1st, The combination, with the cone of a furnace, of one or more arched recesses or chambers, A A, as set forth. 2d, The combination of the opening with the crown of the arch, A, as set forth. 3d, The combination with the arch recess, A, opening, in the crown of the same, of a movable tymp, to be applied to the outer ends of the arched recesses or chambers instead of the permanent tymp now in use, which movable tymp is kept in place by a cross-bar that can be removed at pleasure.

[This invention consists in enlarging the furnace below the base of the stack, so that the blast has a chance to circulate laterally before it passes up into the stack. Enlarging the furnace at its base also allows of vertical flux passages being provided in this character of furnace; and likewise of removable tuyeres, which allow ready access to the interior of the furnace, being used, and renders an ordinary stack furnace capable of melting old railroad bars, &c., as well as all kinds of ores, and reducing the same to the most profitable condition. By circulating the blast, it has been found that very important results are obtained.]

4. COFFEE-POTS; Charles B. Waite and Joseph W. Sener, Fredericksburg, Virginia; patented April 22, 1856; re-issued August 10, 1858; re-re-issued October 18, 1859.

Claim—The employment, in a condensing boiler, in which the water is impregnated with the aroma of the coffee, or other articles under treatment, of a siphon, or equivalent self-acting device, for the discharge of the contents of the condenser into the body of the boiler.

5. CALENDAR CLOCK; Holly Skinner, Huron, Ohio; patented March 2, 1858; re-issued October 18, 1859.

Claim—1st, The extra movable tooth and leap-year wheel, applied to or controlled by the year-wheel, to operate in the manner described, for the purpose of regulating the effective length of the tooth which represents the month of February. 2d, The arrangement of the month-wheel, its attached pinion and pin, the rack-bar and its pawl, the spring, or its equivalent, the lever and its stud, or their equivalents, the catch, or its equivalent, and the stop, the whole being applied to operate upon, and be controlled by, the year-wheel of a calendar movement. 3d, Arranging the month-wheel in such a manner that the same, at the end of each month, returns to its original position by the action of a spring, or its equivalent, gathered up or strained by the action of the clock-work, in the manner described.

6. CONSTRUCTION OF CYLINDERS AND PISTONS FOR PUMPS AND STEAM ENGINES; Wallace Wells, City of N. York; patented October 12, 1858; re-issued October 18, 1859.

Claim—The combination of the cylinder, open at both ends, with three pistons and their connexions, arranged as set forth.

7. LEATHER FINISHING MACHINES; Charles, T. F., and John W. Weston, Salem, Massachusetts; patented September 25, 1855; re-issued October 18, 1859.

Claim—1st, In machines for finishing leather, the employment of a soft elastic bed. 2d, The combination of an elastic bed or tool, both constructed and operating together to produce the desired effect upon the leather. 3d, In combination with the soft elastic bed and elastic finishing tool, the cord secured to the tool-stock, for the purpose of keeping the tool clear of the leather during its retrograde movement over the bed.

8. CLAPBOARD MACHINE; Aretus A. Wilder, Detroit, Michigan; patented October 30, 1855; re-issued October 18, 1859.

Claim—Re-sawing and bringing plank to an equal width at the same time. Also, the flanch rollers, with their springs, or equivalents, in combination with the adjustable back rest, for the purposes described.

9. JOURNAL-BOXES FOR RAILROAD CARS; S. W. Hoffman and Adam J. Frederick, Assignees (through mesne assignment) of Robert McWilliams, Philadelphia, Pennsylvania; patented July 19, 1859; re-issued October 25, 1859.

Claim—1st, The upper half of the box with its socket formed by the flanch, in combination with the lower half of the box, when the two halves are arranged substantially as set forth, so that on adjusting the lower half to its place, it may assume the position shown in fig. 1, and so that when adjusted, the end of the oil chamber shall be close to the axle, for the purpose specified. 2d, The self-adjusting leather-packing and the metal plate, when both are dependent upon the lower half of the box for their proper position within the other half, and when they are otherwise arranged in respect to the upper and lower halves, as set forth.

10. HARVESTERS; W. S. Stetson, Baltimore, Maryland; patented April 5, 1859; re-issued October 25, 1859.

Claim—1st, In combination with a main frame, supported upon two carriage wheels, which frame bears the shaft and main cog-wheel, a second frame hinged to and vibrating about said shaft, so that the crank shaft on said second frame shall always be in a radial line to the main cog-wheel, however much said second frame

may vibrate on the main frame. 2d, Supporting the crank shaft upon a vibrating frame, intermediate between the cutter bar or its shoe, and the main frame, when said main frame bears the main cog-wheel, and said intermediate frame vibrates or turns about an axis parallel to the axis of the driving or carriage wheels.

11. HARVESTERS; W. S. Stetson, Baltimore, Maryland; patented April 5, 1859; re-issued October 25, 1859.

Claim—1st, The main frame which bears the pinion, and has its vibratory motions up and down independent of the motions of the platform and pole, in combination with the vibrating rod intermediate between the said main frame and cutter bar. 2d, Combining the adjusting lever with the platform and main frame, in the manner set forth. 3d, Giving to the main frame which bears the driving pinion, a back and forth motion upon the axle-tree.

12. HARVESTERS; W. S. Stetson, Baltimore, Maryland; patented April 5, 1859; re-issued October 25, 1859.

Claim—The combination of the shoe with the vibrating frame, by means of axis at the rear end of said frame. Also, horsing or supporting the knife-bar in a position at right angles, or nearly so, to the carriage axle by two movements, as set forth.

DESIGNS.

1. BOX STOVE; E. J. Cridge, Troy, New York; dated October 4, 1859.
2. ARMS OF SEWING MACHINES; James S. McCurdy, Brooklyn, New York, Assignor to J. M. Myers, City of New York; dated October 4, 1859.
3. STOVES; Garrettson Smith and H. Brown, Philadelphia, Pennsylvania, Assignors to Hayward, Bartlett & Co., Baltimore, Maryland; dated October 4, 1859.
4. CLOCK-CASE FRONT; Roswell Kimberly, Naugatuck, Connecticut; dated October 11, 1859.
5. TRADE MARK; James H. McLean, St. Louis, Missouri; dated October 11, 1859.
6. ORNAMENTING SEWING MACHINES; Wm. Newton Brown, City of New York; dated October 25, 1859.
7. COOKING STOVES; Andrew John Gallagher, Philadelphia, Pennsylvania; dated October 25, 1859.
8. PARLOR STOVES; C. Harris and Paul W. Zoinier, Cincinnati, Ohio; dated October 25, 1859.
9. FLOOR CLOTHS; Jeremiah Meger, City of New York, Assignor to A. Sampson, Manchester, New Hampshire; dated October 25, 1859.
10. COOKING STOVES; Thomas H. Wood, John E. Roberts, and Henry S. Hubbell, Utica, New York; dated October 25, 1859.
11. ORNAMENTING BOTTLES; L. Q. C. Wishart, Philadelphia, Pennsylvania; dated October 25, 1859.

MECHANICS, PHYSICS, AND CHEMISTRY.

Specification of the Patent granted to SIGISMOND LEONI *for Improvements in the Manufacture of Useful and Ornamental Articles, Surfaces, and Works, Parts of Articles, and Parts of Machinery or Apparatus, from Talc and other Silicates of Magnesia, and from the same combined with other Substances.*—Dated March 21, 1859.*

For this purpose, according to my invention, the talc, steatite, or other silicate of magnesia, is first reduced to powder, and either alone or with the addition of glass, felspar, lime, or alumina, is pressed or forced in a more or less moist or wholly or partially plastic state, into moulds of the desired form or configuration, and, after being removed from the moulds, is baked, burnt, or fired to the requisite hardness. Metallic salts or oxides, carbon, or other coloring agent may be employed, if desired, for imparting color, or for staining. Even in those instances, however, in which I combine with the talc or other silicate of magnesia, glass, lime, felspar, or alumina, I employ only a small proportion of these four last-named substances, so that the silicate of magnesia may be said in all cases to form the main staple of the material treated, according to these my present improvements.

In carrying my invention into effect, the coloring or staining agents which I use, are, by preference, similar to those employed for coloring or staining porcelain, and may be applied by mixing them with the material before pressing it in the moulds, or otherwise, as desirable; or, of course, when preferred, coloring and staining agents may be wholly dispensed with, and the material allowed to retain its original hue. For the baking, burning, or firing, the kilns I use are similar to

* From the Repertory of Patent Inventions, Nov., 1859.

those adopted by porcelain manufacturers, and articles manufactured according to my invention may be enameled, glazed, or polished, by the means ordinarily employed for such purpose in respect of porcelain ware.

My invention is applicable to the manufacture of knife handles, spindle steps, bearings, toilette furniture, decorative mouldings, and various other articles, surfaces, and works, and parts of articles, and parts of machinery or apparatus, in which strength, hardness, and durability, and resistance to heat, friction, corrosion, or oxydation, &c., &c., are desirable qualities.

Claim, manufacturing articles, surfaces, and works, parts of articles, and parts of machinery or apparatus, from talc or other silicates of magnesia, alone or combined with other substances, in the manner hereinbefore described.

For the Journal of the Franklin Institute.

Particulars of the Steamer Alabama.

Hull built by Samuel Sneden. Machinery by Morgan Iron Works, New York. Owners, I. L. Day, and others.

HULL.—

Length on deck,	235 feet.	
" between perpendiculars,	225 "	
Breadth of beam, molded,	32 "	2 inches.
Depth of hold to spar deck,	9 "	
Frames—molded, 3½ ins.—sided, 5-16—apart at centres, 17 ins. Shape ⌐⌐; width of flanches, 3½ ins.; thickness of plates, 5-16 to ⅜-inch.		
Cross floors—⌐ 15 ins. high by 5-16 in. thick. Diameter of rivets, ⅞ in.—apart, 2¼ ins. single riveted.		
Draft of water, forward and aft, loaded,	4 "	
Tonnage,	656.	
Area of immersed section at above draft,	115 sq. ft.	

ENGINES.—Vertical beam.

Diameter of cylinder,		50 inches.
Length of stroke,	10 feet.	
Maximum pressure of steam,	25 lbs.	
Cut-off—one-half.		

BOILERS.—One—Return flue.

Length of boiler,	30 feet.	
Breadth " at furnace, 12 ft., at shell, diameter,	10 "	9 inches.
Height " exclusive of steam chimney,	10 "	9 "
Number of furnaces,	3.	
Breadth "	3 "	7 "
Length of grate bars,	7 "	
Number of flues, { above, 6 of 18 inches, and 6 of		9 "
Number of flues, { below, 2 of 10 inches, and 8 of		15 "
Length of flues, { above,	26 "	
Length of flues, { below,	17 "	5 "
Diameter of smoke pipe,	4 "	2 "
Height "	30 "	

PADDLE WHEELS.—

Diameter, over boards,	29 feet	6 inches.
Length of blades,	8 "	
Depth "		24 "
Number "	26.	

Remarks.—One independent steam, fire, and bilge pump. Four bulkheads. Saloon on main deck and saloon cabin above. Date of trial, October, 1859. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the U. S. Steam Sloop Narragansett.

Hull built by U. S. Government at Charlestown Navy Yard. Machinery by Boston Locomotive Works.

HULL.—

Length for tonnage,		188 feet	6 inches.
" on deck, from knighthead to taffrail,		208 "	
" deep load water line,		186 "	6 "
Breadth of beam at midship section, extreme,		31 "	6 "
Depth of hold,		14 "	1 "
" " to berth deck, (to under side of berth deck beams,)		5 "	11 "
Length of engine and boiler space,		49 "	
Shaft, above base line,		5 "	4 "
Draft of water at deep load line,		10 "	
Tonnage, carpenter's measurement,	930 tons.		
Area of immersed section at load draft,	252 sq. ft.		
Displacement at load draft,	1043·06 tons.		
Contents of bunkers in tons of coal,	193 tons.		
Masts and rig—3 masts and bark rigged.			

ENGINES.—Two—Horizontal—Back action.

Diameter of cylinder,			48 inches.
Length of stroke,		2 feet	4 "
Diameter of shaft, propeller,			9¼ "
" " crank (in journals),			10¼ "
Maximum pressure of steam in pounds,	20 lbs.		
Cut-off—adjustable slide.			
Maximum revolutions per minute,	80.		
Weight of engines,	80 tons = 179,200 lbs.		
Length " in ship, fore and aft,		13 "	8 "
" " athwart ships,		15 "	4 "

BOILERS —Martin's Vertical tubular.

Length of boilers,		10 "	2 "
Breadth "		18 "	5 "
Height " exclusive of steam drum,		10 "	6 "
" " inclusive "		11 "	6 "
Number of furnaces in all,	11.		
Breadth "			36 "
Length of grate bars,		6 "	
Number of tubes (brass),	3190.		
External diameter of tubes,			2 "
Length of tubes, extreme,			32 "
Heating surface,	5945·7 sq. ft.		
Grate surface,	200 sq. ft.		
Diameter of smoke pipe,		6 "	
Height " above grates,		50 "	
Description of coal,	Anthracite.		
Draft,	a screw fan.		

SCREW.—

Diameter of screw,		9 feet	6 inches.
Length "			37½ "
Pitch "		18 "	
Number of blades,	2.		

AIR PUMPS.—Number and diameter of salt, } one of each, { 18½ inch.
" " " fresh, } { 13¾ "

Pirsson's Condenser—Number of tubes, 3705.

Outside diameter, ⅝. Inside diameter, ½. Length, 4 feet 10 inches over all. Tube sheets ¾ thick.

M.

For the Journal of the Franklin Institute.

Particulars of the Steamer George Anna.

Hull and machinery by Harlan & Hollingsworth & Co., Wilmington, Del. Owners, George R. H. Leffler.

HULL.—

Length on deck,		208	feet
Breadth of beam, (molded)		30	"
Depth of hold,		10	"
" " to spar deck,		18	"
Length of engine room,		60	"

Frames—18 ins. apart from centres. Shape |; depth 3 ins. width $\frac{3}{4}$ in.

Plates—strakes from keel to gunwale 11; thickness $\frac{1}{2}$, 7-16, and $\frac{3}{8}$ inch.

Cross Floors—13 of 18 inches in height, × $\frac{3}{4}$ and 7-16 with angle iron on top.

Keel—dimensions U 6 × $\frac{1}{2}$ in.

Rivets—diameter $\frac{3}{8}$, distance apart 2 ins. single riveted.

Draft of water,		6	"
Tonnage,	574 65-95.		
Area of immersed section at load draft of 6 ft.,	168 sq. ft.		

ENGINE.—Vertical beam.

Diameter of cylinder,			44 inches.
Length of stroke,		11	feet
Maximum pressure of steam,	30 lbs.		

Cut-off—one-half.

Maximum revolutions per minute at above pressure,	22.		
Weight of engines,	210,000 lbs.		

BOILERS.—One—Tubular.

Length of boilers,		14	feet.	
Breadth "		14	"	
Height " exclusive of steam chimney,		11	"	6 inches.
Weight " with water,	90,000 lbs.			
Number of furnaces,	4.			
Breadth "	3 ft. 6 in. and	2	"	6 "
Length of grate bars,		6	"	
Number of tubes, { above,	154.			
Number of tubes, { below,	4 arches.			
Internal diameter of tubes, { above,				$3\frac{3}{4}$ "
Internal diameter of tubes, { below,	same as furnace.			
Length of tubes,		5	"	6 "
Heating surface,	2114 sq. ft.			
Diameter of smoke pipe,		4	"	6 "
Height " above grates,		46	"	
Consumption of coal per hour,	about $\frac{3}{4}$ ton.			

PADDLE WHEELS.—

Diameter over boards,		28	feet.
Length of blades,		8	"
Depth "			22 inches.
Number "	20.		

Remarks.—One independent steam, fire, and bilge pump. Three bulkheads. Ceiling $1\frac{1}{2}$-in. pine. Date of trial, September, 1859.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Penguin.

Hull built by C. H. Mallory, Mystic, Conn. Machinery by C. H. Delamater, New York. Owners, Commercial Steamboat Company. Intended service, New York to Providence, R. I.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,	165 feet.		
Breadth of beam at midship section, above the main wales,	30 "	8 inches.	
Depth of hold,	10 "		
Length of engine space,	10 "		
Floor timber, at throat—molded, 14 ins.—sided 9 to 11 ins. apart at centres, 26 ins.			
Draft of water at load line,	12 "		
" " below pressure and revolutions,	11 "		
Tonnage,	460.		
Area of immersed midship section at load line of 12 feet,	323 sq. ft.		
Masts and rig—three-masted schooner.			

ENGINE.—Vertical direct (Ericsson's patent).

Diameter of cylinders, two,		48 inches.
Length of stroke,	2 feet.	
Maximum pressure of steam in pounds,	30.	
Maximum revolutions per minute,	70.	

BOILERS.—One—Return tubular.

Length of boiler,	20 feet.		
Breadth "	14 "		
Height " exclusive of steam chimney,	13 "	6 inches.	
Number of furnaces,	3.		
Breadth "	4 "		
Length of grate bars,	7 "	6 "	
Number of tubes,	93.		
Internal diameter of tubes,		3½ "	
Length of tubes,	15 "		
Heating surface,	2000 sq. ft.		
Diameter of smoke pipe,	4 "	2 "	
Height "	20 "		

PROPELLER.—

Diameter of screw,	11 feet	6 inches.	
Pitch "	20 "		
Length of blades,	4 "	6 "	
Number	4.		

Remarks.—Spar deck inclosed. C. H. H.

Electric Brakes for Railroads.

The *Cosmos* mentions the electric brake of M. Achard as having been entirely successful, either for checking or arresting the motion of the trains. With express trains, whose wheels are making from 400 to 500 turns in a minute, the rotation is stopped in a second, and the train slides over a distance of from 60 to 80 metres (yards). It will be remembered that a correspondent in a late number of the *Jour-*

nal, spoke of these brakes as having failed and been abandoned, but he appears to have been mistaken. The first experiments we remember to have heard of, on the application of magnetism to the purpose of brakes, were at or near Pittsburg. Can any of our readers refer us to the publication in which an account of them may be found? ED.

For the Journal of the Franklin Institute.

Particulars of the Steam-tug Indio.

Hull and machinery built by Harlan & Hollingsworth & Co., Wilmington, Del. Owners, Fernando J. L. Calvo.

HULL.—

Length on deck,	86 feet.	
Breadth of beam, (molded)	18 "	
Depth of hold, to spar deck,	8 "	
Length of engine room,	30 "	
Frames—18 ins. apart from centres. Shape |; depth 3 ins. width of web ⅜-in.		
Plates—strakes from keel to gunwale 7; thickness 5-16 in.		
Cross floors—9 of 22 ins. height × 5-16 in. thick.		
Keel—depth 12 ins. dimensions ⅞ ∪.		
Rivets—diameter ⅞-in.; distance apart 2 in. Single riveted.		
Draft of water,	6 "	9 inches.
Tonnage,	113 93-95.	
Area of immersed section at load draft of 6 feet 9 inches,	78 sq. ft.	

ENGINE.—Vertical direct.

Diameter of cylinder,		26 inches.
Length of stroke,	2 feet.	
Maximum pressure of steam,	40 lbs.	
Cut-off—one-half.		
Maximum revolutions per minute, at above pressure,	100.	
Weight of engines,	28,000 lbs.	

BOILER.—One—Return flue.

Length of boiler,	13 feet	6 inches.
Breadth "	7 "	
Height " exclusive of steam chimney,	7 "	
Weight " with water,	34,000 lbs.	
Number of furnaces,	2.	
Breadth "	3 "	
Length of grate bars,	5 "	6 "
Number of flues, above,	14.	
Number of flues, below,	6.	
Internal diameter of flues, above,		6 "
Internal diameter of flues, below,	8, 12, & 16	"
Length of flues, above,	9 feet	6 "
Length of flues, below,	6 "	
Heating surface,	552 sq. ft.	
Diameter of smoke pipe,	3 "	2 "
Height " above grate,	30 "	6 "
Consumption of coal per hour,	about ½ ton.	

PROPELLER.—

Diameter of screw,	7 feet.	
Length "	2 "	10 inches.
Pitch "	12 "	
Number of blades,	4.	

Remarks.—One bulkhead. Date of trial, July, 1859. C. H. H.

*On the Application of Superheated Steam in Marine Engines.**

By Mr. J. PENN, President.

The paper was of a technical character, but of great interest to practical men. The writer stated that an opinion in favor of superheating the steam supplied to steam engines had long existed, and it had been maintained that important advantages might be obtained from this principle, though until recently but little had been effected in its practical application. Superheated steam seemed to have been first definitely tried by Mr. Thomas Howard, of Rotherhithe, about twenty-seven years ago. Considerable economy was effected, but the machine was too delicate in its construction to test the experiment properly (though it established the principle), and it was given up. Soon afterwards Dr. Haycroft, of Greenwich, took up the subject, and was convinced of its advantages. The importance of the principle was first impressed upon the writer many years ago, and he became satisfied, from the results of experiment and observation, that great advantages in economy of fuel might be obtained, the main question to be settled being whether it involved any serious practical objection from complication of apparatus, risk of derangement and failure, or difficulty in lubrication of the engine. Recent trials, made on a large scale, led the writer to the following conclusions:—That an advantage can be obtained from the use of superheated steam, amounting to an economy of fuel of from 20 to 30 per cent. in marine engines; that a moderate extent of superheating enables all the important advantages of the plan to be obtained; and that apparently nothing objectionable is then necessarily involved from extra wear and tear, risk of failure, complication of apparatus, or difficulty in lubrication. The real advantage in employing superheating steam appeared to be in preventing the presence of any water in the cylinder of the engine, and ensuring that it should be occupied always by nothing but pure steam; making it a real steam engine, instead of one working with a mixture of water and steam. In all condensing engines the interior of the cylinder, being open to the condenser during half the time of each revolution of the crank, was exposed during that time to the low temperature of the condenser, or about 125 degrees, with a vacuum of 13½ lbs. per inch below the atmosphere, or 27 inches of mercury. There was, consequently, a rapid absorption and radiation of heat from both the sides and the end of the cylinder, thus cooling down the whole mass of metal. The steam admitted into the cylinder in the next stroke, at a temperature of 260 deg. if at 20 lbs. per inch above the atmosphere, coming in contact with these cooled surfaces, heated them up again, being robbed thereby of a portion of its heat; and the consequence was the deposit of a quantity of water in the cylinder, from the condensation of an amount of steam proportionate to the quantity of heat imparted to the metal of the cylinder. A portion of this water in the cylinder might be evaporated again into steam towards the end of the stroke, by carrying the expansion of the steam down to a sufficiently low pres-

* From the Lond. Mechanics' Mag., Sept., 1859.

sure: but even then its effective value as steam in propelling the piston would have been lost during all the previous position of the stroke. Now, if as much heat be added to the steam, by superheating it before entering the cylinder, as would supply the amount of which it was robbed by the cylinder, it would remain perfectly dry steam throughout its stroke, and not a drop of water would be deposited. This, the writer believed, was the mode in which the superheating of steam acted in producing a saving of steam, and consequent economy of fuel, by preventing the extensive loss or waste of steam that ordinarily took place. The addition of 100 degs. of heat to the temperature of the steam insured the accomplishment of the desired object with steam at 20 lbs. per inch, as used in marine engines. The writer then proceeded into more technical details, reference being frequently made to the diagrams, and said, that having fitted the engines of the Peninsular and Oriental Company's steamer *Valletta* with superheating apparatus (illustrated by diagrams), the experiments made gave a saving of 20 per cent. of fuel. These experiments were not complete, but they were entirely satisfactory as far as they went.—A very interesting though technical discussion ensued, in which Mr. W. S. Ward, Mr. Morrison, Mr. Cowper, Mr. Maudslay, the President, and other gentlemen took part; after which a vote of thanks was passed to the President for his paper.—*Proceedings of the Ins. of Mech. Engineers.*

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*Artificial Statuary Marble.** By M. Jobard.

The following is extracted from the foreign correspondence of the *Star:*—"M. Jobard, of Brussels, who has almost suffered himself to be forgotten, from the lengthened and unusual silence he has maintained for some time past, has come out again as enthusiastic and vivacious as ever with his invention of artificial statuary marble—not the veiny, greasy stuff in use for chimneys and vases, but the pure and spotless Carrara, transparent, polished, and hard as the real substance taken from the quarry. This marble, which is to be prepared for the sculptors in a liquid state, will, like many other artificial inventions, possess an immense advantage over the natural production itself. It can be moulded on the plaster figure, and thus, instead of having to hack and hew a shapeless block with great pains and labor, the artist will henceforth realize the genuine impression of his cast at once, and, with scarcely any further exertion, bring out his creation with all the freshness and vigor of the first idea. The invention, which has created an immense sensation in the world of art, is due to a practical chemist of Brussels, of the name of Changy, the same skilful practitioner who discovered the divisibility of the electric light, and the miraculous draft of fishes by means of the chemical light which is sunk at the bottom of the sea. M. Jobard, whose word cannot be doubted, pledges his honor that the table on which he writes has been composed by M. Changy's process, and possesses every quality of the finest marble—and

* From the Mechanics' Magazine, Sept., 1859.

that, after having submitted various specimens of the substance, both black and white, to every chemical test in use, he has come to the conclusion that the composition of marble is no longer a secret of Dame Nature, and that man has at length learnt to rival her in the most cunning of her works, while Art will rejoice at beholding her sons freed from the laborious toil which has hitherto rendered the sculptor's profession difficult of pursuit."

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*A New and Simple Method of Extracting the Roots of All Powers.**

The extraction of roots without the use of logarithms, has hitherto been a task so tedious and perplexing that a correct and easy solution of all questions in evolution will be welcomed, not only by mathematicians, but also by the schoolmaster, as the time at present wasted upon almost impracticable formulæ will be usefully employed in the attainment and understanding of an important process; and the following rule is proposed for adoption in preference to others, which, with double the labor, yield only approximate results.

By this method the approach to truth is so rapid, that, with a slight exercise of judgment in selecting the trial root, either from memory or inspection, the true root is obtained more easily and more quickly than by the use of logarithms, and the operator is made independent of tables, which are not always available for reference.

The practical utility of this rule in questions of many periods, is shown by there being no necessity for prosecuting the division of large numbers beyond two or three quotient figures in each trial. (See example 3.)

The process is based upon the slow increase of the root compared with the expansion of the number raised by any power; and the error of supposition in the trial root is compensated by the mean taken (see examples 1, 2) where the trial roots are purposely taken wide of the apparent roots to show how quickly they converge to the true root.

Rule for the Extraction of the Roots of All Powers.

1st. Divide the given number by the trial root passed to the next less power. To the quotient add the trial root multiplied by the index of the next less power, and divide the sum by the index of the given power for a new trial root, with which repeat this simple operation, if necessary:—

Example, merely to show the process:—

Find the cube root of 8, using its true root, 2, for a trial root:—

2 (*i. e.* raised by ^{2} next less power to the cube),	4)8
	2 (*see note.*)
Add 2 (the trial root × by next less power 2),	4
÷ by given power, the cube,	3)6
	2 True root.

* From the Lond. Builder, No. 866.

NOTE.—The true root and the trial root need not necessarily agree; but when they do, or when the trial root and the first quotient are alike, the true root is found without proceeding further; also when the root repeats itself in the second operation it is the true root. (See Example 1.)

EXAMPLES.

1st. Find $\sqrt[3]{}$ of 125, assuming 4 for a trial root.

$4^3 = 16)125$

$7{\cdot}81 + 8 = {}^3)15{\cdot}81$

$5{\cdot}27$ New root.

Here we learn that it is *nearer* the 5 found than the 4 assumed; then try 5. $5^3 = 25)125$

5 The true root at once.

But with 4·9 or 5·1 :—

$4{\cdot}9^3 = 24{\cdot}01)125$	$5{\cdot}1^3)125$
$+5{\cdot}2$	$4{\cdot}8+$
$+9{\cdot}8$	$10{\cdot}2+$
$3)15.$	$3)15{\cdot}0$
$5\cdot$ { Root repeats with either. } $5\cdot$	

2d. Find $\sqrt[3]{}$ of 1728 by trial of 10, 11, and 13.

$10^3 = 100)1728 + 20 = {}^3)37{\cdot}28 = 12.42$

$11^3 = 121)1728$

$143 + 22 = {}^3)36{\cdot}3 = 12{\cdot}1$

$13^3 = 169)1728$

$10{\cdot}22 + 26 = {}^3)36{\cdot}22 = 12{\cdot}07$

$12^3 = 144)1728 = 12$ True root.

3d. Required $\sqrt[3]{}$ of 10·9739039780850 48. Try either 2·1, 2·2, or 2·3, because we know them to be something near the root of 10. Take 2·2.

$2{\cdot}2^3$ $4{\cdot}84)10{\cdot}97390(2{\cdot}267$

$4{\cdot}4$

$3)6{\cdot}667$

$2{\cdot}222$

$2{\cdot}22$ Try

$4{\cdot}9284)10{\cdot}9739039(2{\cdot}22666$

$4{\cdot}44$

$3)6{\cdot}66666$

True root . . . . . 2·22222

The facilities and perfect accuracy of the rule are here apparent.

SQUARE ROOTS.

The extraction of the square root is, by this method, a question of simple division.

4th. Find square root of 765625. Try 860.

$$\begin{array}{r} 86{\cdot}0)765625(890 \\ 860 \\ \hline 2)1750 \\ \hline 875 \text{ True root.} \end{array}$$

FORMULA.

Let

a = given number
b = trial root
x = true root

} When $x^n = a$.

Then $x = \frac{1}{n}\left(\frac{a}{b^{n-1}} + b\,(n-1)\right)$ Nearly or quite.

CHARLES HOARE,
Author of "Mensuration made Easy," &c.

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*Manufacture of Horn, Hoof, and Tortoise-shell Articles from Raspings, Saw-dust, and Waste.**

Horn, as a raw material, is possessed of many qualities which would render it well fitted for working up in the better kinds of furniture and cabinet work, were it not that it is limited in size to such comparatively small plates as the natural animal growth, when opened out flat, will produce. It is hard, and very durable, whilst it works easily and is of great cohesive strength; being capable of withstanding a tensile strain of from 12,000 to 16,000 pounds. per square inch, before giving way. It is also capable of receiving a very high and fine polish without the aid of paste, varnish, or other foreign matter. Now, if, with all these qualifications, we could obtain horn in plates or masses of superior size, we should at once bring the material into wide use for a multitude of purposes, to which, at present, it cannot be applied, by reason of its irregular shape and diminutive size. Such a result appears to have first been satisfactorily obtained by Mr. James Macpherson, the comb manufacturer of Aberdeen. This gentleman has very ingeniously discovered, that by the simplest possible process, he can solidify the raspings, saw-dust, and other waste of horns, hoofs, and tortoise-shell so as to produce large plates, sheets, and blocks of fine solid horn. He has also found that by a generally similar course of procedure, he can solidify, cement, or join portions of his raw materials, so as to secure, not only an increase in dimensions, but also a variety and increased beauty of effect, as regards color and fibre—as when

* From the Lond. Practical Mechanic's Journal, June, 1859.

two kinds of horn, or horn and shell, are joined together, or when differently colored portions are cemented into one mass.

In preparing a slab or a moulded article from the waste material, Mr. Macpherson proceeds by primarily placing a quantity of the disintegrated material, well cleansed and freed from grease and foreign matters, in a pressing cloth. The mass so bound up, is then soaked in water, which may either be boiling or have been previously boiled, so as to expel the air, which would otherwise interfere, to some extent, with the cohesion of the particles: water, in which is dissolved about one ounce of lime and one and a half ounces of potash to each three gallons, is the best suited for this fluid treatment. The moistening so given to the horn, begins the process of decomposition, thereby cleansing the surfaces and rendering them properly fitted for uniting. The moistened and partially softened mass is then enclosed in a preparatory mould, heated up to nearly the temperature ordinarily used in pressing and moulding articles of horn, or about 300° Fahrenheit. Pressure is then applied to the mould, so as to expel all the superfluous moisture, and bring the material into a block or slab of nearly the size and shape of the article wanted. After being allowed to remain in the mould for a few minutes, to give the mass firmness and consistency, it is withdrawn, and subsequently placed in the finishing mould, which is, of course, of the exact size and shape of the article to be made. In this stage of the operation, the greatest care must be taken to secure a fine regular heat, just as if the article were to be pressed and moulded in solid horn, as at present practised. The mould surface must be free from oleaginous matter; but to prevent adhesion, it may be very lightly touched with fine grease. In this moulding operation, the block may be inlaid with metal or pearl for ornamental work. The smaller and finer the waste dust used, the finer will be the work; so that it is advisable to preserve the finest and purest material for the surfaces, whilst the coarser portions are kept in the centre. Much of the excellence of the work produced, will, of course, depend upon the moulds and the pressure used in working them—as a pressure of from 3000 to 4000 lbs. per square inch is necessary for securing the due solidification of the particles.

From 60 lbs. of horn saw-dust or shavings, a fine slab of an area of 12 square feet, and three-fourths of an inch in thickness, suitable for the top of a table, can be produced—of course, such a slab may be of any form and of a variable thickness, just as the exigencies of the design may demand. The moulded surfaces are perfectly smooth, directly from the mould; but the polishing is an after process, although the dyeing or artificial coloring, when that is required, can be performed simultaneously with the actual moulding—the raw materials themselves being dyed or stained prior to the pressure being applied.

The same general principle applies also to the cementing or junction of distinct pieces of horn, hoof, or tortoise-shell. In this process, the pieces are neatly fitted together, and then moistened, the parts being covered over with paper to confine the water and steam, and prevent the atmosphere from acting upon the surfaces at the instant of cementation. A pair of tongs, suitable for grasping the scarfed

portions, are then heated to the proper moulding temperature, and the parts grasped therewith are then placed in a vice, with sufficient squeezing force upon them to cause the work to extend under the tongs.—The work is then left until it is cold, when a perfect joint is produced, the whole mass being homogeneous.

The simplicity of the entire process is a great feature in its favor, and, as the moulded material presents all the appearance of real solid horn, with many artificial beauties which that material does not possess, it is reasonable to suppose that the invention will work a considerable change in the horn and collateral manufactures. One pound weight of natural horn, contains about 22 cubic ins. of material, and the solidified horn is of about the same density, although from its appearance, and we have several samples of the work before us, the artificial substance seems even more dense. It never becomes fluid during the treatment which it receives, and in all the operations of bringing up and polishing the surface, it is subject to all the conditions and laws affecting the natural material from which it is made, when in its original form; the only difference is, that the new material is fibreless, there being no grain in it, so that it is equally strong in all directions.

Mr. Macpherson has submitted seven of his early samples to us.—One of these consists of two pieces of horn cemented together, the two being chosen of very dissimilar colors, and set with their natural grains crossing each other, so as to exhibit the accuracy and beauty of the junction very clearly. Another is composed of two pieces of hoof similarly cemented. These pieces present an excellent effect, more like tortoise-shell than ordinary horn. A third specimen shows what can be obtained by dyeing the dust black prior to the first moulding, and then inlaying the surface with silver, in the after moulding process. The other samples show the plain moulded saw-dust prior to polishing —a slab of moulded shavings dyed in the first process—a slab of solidified horn dust as taken off by the grind-stones in reducing horn combs—and a highly polished slab of solidified dust. The material seems well suited for ornamental panels, work-boxes, dressing-cases, door-knobs, and other articles not easily made out of natural horn.

As to the labor cost of producing articles from the artificial material, it is to be remembered that in treating ordinary horn or hoof, it must be all dressed clean with a knife before it can be put into a mould, and there is always a loss of material of from 25 to 50 per cent. of the whole. This work is done by a skilled mechanic, and occupies a large amount of time. On the other hand, the waste material can be weighed out to the exact quantity for the article to be made, and no loss arises; and when artificial coloring is necessary, the waste can be all dyed through by simple immersion in the boiling dye for a few minutes, whilst solid horn takes some hours to dye, and is then only stained on the surface. The solid tops of horn, when good, sell for £30 a ton; the waste can be had for £6 or £8 a ton, and a greater relative quantity can be turned to useful account from the waste than from solid horn. The process thus affords a means of economically working up what is otherwise a cheap waste material, of which many hundred tons are annually produced in this country.

*New Plastic Metallic Alloy.**

This metallic alloy, which has been discovered by M. Gersheim, not only adheres forcibly to other substances or compositions, such as glass and porcelain, but serves also to unite them in the same way as mastic. After ten or twelve hours, this plastic alloy attains a hardness which renders it capable of bearing a high polish, similar to silver or brass.

In preparing this alloy, oxide of copper is reduced by means of hydrogen, or sulphate of copper is precipitated with zinc parings. By this means a pure copper is obtained, twenty, thirty, or thirty-six parts of which are taken according to the hardness desired—the more copper in the alloy the greater being the hardness thereof. This is moistened in a cast iron or porcelain mortar with concentrated sulphuric acid, of a density of 1·85. To this species of metallic paste are added seventy parts by weight of mercury—the mass being kept continually stirred or agitated. When the copper is completely amalgamated, the composition is washed with boiling water to remove the sulphuric acid; it may then be left to cool, and ten or twelve hours will be sufficient to render it hard enough to bear an excellent polish, and to scratch tin and bone. It is not acted upon either by weak acids, alcohol, ether, or boiling water; and its density remains the same whether it is plastic or hard. When required as a mastic, it may at any time be reduced to a soft and plastic condition by submitting it to a heat of about 375° Centigrade, and working it in an iron mortar, heated to about 125° Centigrade, until it has attained the malleability and consistency of wax. If in this state it is placed between two metallic surfaces well freed from oxidation, it will unite them so perfectly that in ten or twelve hours afterwards they may be submitted to any usage. This composition, in a soft state, may also be poured into hollows, into which it will adhere forcibly after it has hardened, as it is found that it does not shrink in changing its condition.

The peculiar properties of this alloy admit of its application to a great variety of uses, but it is especially useful in the uniting of metallic surfaces where it would be inconvenient to employ heat for soldering or brazing the parts. Whilst on this subject, we may mention that Professor Pettenkofer, of Munich, discovered a sure method of preparing the amalgam of copper, which is now employed by dentists in stopping teeth, as far back as 1845.

On the Specific Gravities of Alloys.† By F. Crace Calvert, Ph.D., F.R.S., F.C.S., and Richard Johnson, F.C.S., &c.

The study of alloys and amalgams having been made especially with impure or commercial metals, the results obtained have been such that it has been impossible to solve the important question, Are alloys and amalgams chemical mixtures or compounds? It is with the hope of throwing some light on this subject, that we have for the last two years

* From the Practical Mechanic's Journal, Nov. 1850.
† From the Lond., Edin., and Dub. Philosophical Mag., Nov., 1850.

been engaged in examining comparatively some of the physical properties, such as the conductibility of heat, tenacity, hardness, and expansion of alloys and amalgams made with pure metals, and in multiple and equivalent quantities, as follows:—

1 Copper and 1 Tin.	1 Tin and 2 Copper.
1 " and 2 "	1 " and 3 "
1 " and 3 "	1 " and 4 "
1 " and 4 "	1 " and 5 "
1 " and 5 "	

By this method we have succeeded in ascertaining, first, the influence which each additional equivalent quantity of a metal exerts on another; secondly, the alloys which are compounds and those which are simple mixtures; for compounds have special and characteristic properties, whilst mixtures participate in the properties of the bodies composing them. This method of investigating alloys and amalgams has enabled us to ascertain which metals combine together to form definite compounds, and those which, when melted together, only form mixtures. Thus, for example, bronze alloys are definite compounds, for each alloy has a special conductibility of heat. Thus the alloy.

	Obtained.	Calculated.*	Difference.
Sn Cu^2	13·65	19·87	6·22
Sn Cu^3	15·75	21·37	5·62
Sn Cu^4	4·96	21·88	16·92
Sn Cu^5	6·60	22·50	15·90

These same alloys have a specific gravity of their own. Thus:—

	Obtained.	Calculated.*	Difference.
Sn Cu^2	8·533	8·059	0·474
Sn Cu^3	8·954	8·208	0·756
Sn Cu^4	8·948	8·306	0·642
Sn Cu^5	8·965	8·374	0·591

The same fact is also observed in the expansion or contraction of these alloys. Whilst, on the contrary, the alloys of tin and zinc being mixtures, conduct heat, have a specific gravity, and expand according to theory, or the proportion of tin and zinc which compose each alloy. Thus for heat:—

	Obtained.	Calculated.*	Difference.
Zn Sn^2	15·15	14·90	0·25
Zn Sn	16·00	15·80	0·10
Zn^2 Sn	16·65	16·95	0·30

Specific Gravity.

	Obtained.	Calculated.*	Difference.
Zn Sn^2	7·274	7·193	0·081
Zn Sn	7·262	7·134	0·128
Zn^2 Sn	7·188	7·060	0·128

We shall divide our researches on the specific gravity of alloys and amalgams under two heads: first, those which have a higher specific gravity than indicated by theory; and secondly, those which have a less specific gravity or expand.

* The principle upon which the theoretical conductibility, specific gravity, and expansion are calculated, is similar to that followed with respect to hardness, for which see page 4 of our paper "On Hardness."
(See Jour. Franklin Ins. present Series, Vol. xxxvii. p. 199.)

I. Alloys which have a higher specific gravity than indicated by theory. Results:—

Copper and Tin (Bronze).

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Cu\,Sn^5$ { Cu 9·73 / Sn 90·27 }	7·517	7·431	0·086
$Cu\,Sn^4$ { Cu 11·86 / Sn 88·14 }	7·558	7·462	0·096
$Cu\,Sn^3$ { Cu 15·21 / Sn 84·79 }	7·606	7·514	0.092
$Cu\,Sn^2$ { Cu 21·21 / Sn 78·79 }	7·738	7·580	0·158
$Cu\,Sn$ { Cu 34·98 / Sn 65·02 }	7·992	7·805	0·187
$Sn\,Cu^2$ { Sn 51·83 / Cu 48·17 }	8·533	8·059	0·474
$Sn\,Cu^3$ { Sn 38·21 / Cu 61·79 }	8·954	8·208	0·746
$Sn\,Cu^4$ { Sn 31·73 / Cu 68·27 }	8·948	8·306	0·642
$Sn\,Cu^5$ { Sn 27·10 / Cu 72·90 }	8·965	8·374	0·591
$Sn\,Cu^{10}$ { Sn 15·68 / Cu 84·32 }	8·832	8·545	0·287
$Sn\,Cu^{15}$ { Sn 11·03 / Cu 88 97 }	8·825	8·615	0·210
$Sn\,Cu^{20}$ { Sn 8·51 / Cu 91·49 }	8·793	8·634	0·159
$Sn\,Cu^{25}$ { Sn 6·83 / Cu 93·17 }	8·820	8·677	0·143

Copper and Zinc (Brass).

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Zn\,Cu^5$ { Cu 82·95 / Zn 17·05 }	8·673	8·453	0·220
$Zn\,Cu^4$ { Cu 79·56 / Zn 20·44 }	8·650	8·387	0·263
$Zn\,Cu^3$ { Cu 74·48 / Zn 25·52 }	8·576	8·290	0·286
$Zn\,Cu^2$ { Cu 66·06 / Zn 33·94 }	8·488	8·129	0·359
$Zn\,Cu$ { Cu 49·32 / Zn 50·68 }	7·808	8·319	0·511
$Cu\,Zn^2$ { Cu 32·74 / Zn 67 26 }	7·859	7·489	0 370
$Cu\,Zn^3$ { Cu 24·64 / Zn 75·36 }	7·736	7·334	0·401
$Cu\,Zn^4$ { Cu 19·57 / Zn 80·43 }	7·445	7·237	0·208
$Cu\,Zn^5$ { Cu 16·30 / Zn 83·70 }	7·442	7·174	0·268
Copper and Bismuth.			
Cu Bi	9·634	9·566	0·068
Copper and Antimony.			
Cu Sb	7·990	7·386	0·604

Tin and Zinc.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Zn\ Sn^2$ { Zn 21·65 / Sn 78·35 }	7·274	7·193	0·081
$Zn\ Sn$ { Zn 35·60 / Sn 64·40 }	7·262	7·134	0·128
$Sn\ Zn^2$ { Sn 47·49 / Zn 52·51 }	7·188	7·060	0·128
$Sn\ Zn^3$ { Sn 37·57 / Zn 62·43 }	7·180	7·021	0·159
$Sn\ Zn^4$ { Sn 31·14 / Zn 68·86 }	7·155	6·993	0·162
$Sn\ Zn^5$ { Sn 26·57 / Zn 73·43 }	7·140	6·974	0·166
$Sn\ Zn^{10}$ { Sn 15·32 / Zn 84·68 }	7·135	6·927	0·208

II. Alloys and amalgams having a less specific gravity, or which expand.

Mercury and Tin.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Hg\ Sn$ { Hg 62·97 / Sn 37·03 }	10·255	11·259	1·004
$Hg\ Sn^2$ { Hg 45·88 / Sn 54·12 }	9.314	10 180	0·866
$Hg\ Sn^3$ { Hg 36·18 / Sn 63 82 }	8 805	9·568	0·763
$Hg\ Sn^4$ { Hg 29·84 / Sn 70·16 }	8·510	9·168	0·658
$Hg\ Sn^5$ { Hg 25·38 / Sn 74·62 }	8·312	8·885	0·573
$Hg\ Sn^6$ { Hg 22·08 / Sn 77·92 }	8.151	8·678	0·527

Mercury and Bismuth.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Hg\ Bi$ { Hg 48·44 / Bi 51·56 }	11·208	11·638	0·430
$Hg\ Bi^2$ { Hg 31·82 / Bi 68·18 }	10·693	11·007	0·314
$Hg\ Bi^3$ { Hg 23·86 / Bi 76·14 }	10·474	10·704	0·230
$Hg\ Bi^4$ { Hg 19·03 / Bi 80·97 }	10·350	10·522	0·172
$Hg\ Bi^5$ { Hg 15·82 / Bi 84·18 }	10·240	10.410	0·170
Mercury and Zinc.			
Hg Zn	11·304	11·944	0·640

Antimony and Bismuth.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Bi\ Sb^5$ { Bi 24·81 / Sb 75·19 }	7·271	7·470	0·201
$Bi\ Sb^4$ { Bi 29·20 / Sb 70·80 }	7·370	7·606	0·235
$Bi\ Sb^3$ { Bi 35·48 / Sb 64·52 }	7·561	7·801	0·240
$Bi\ Sb^2$ { Bi 45·21 / Sb 54·79 }	7·829	8·102	0·273
$Bi\ Sb$ { Bi 62·26 / Sb 37·74 }	8·364	8·630	0·268
$Sb\ Bi^2$ { Sb 23·26 / Bi 76·74 }	8·859	9·077	0·218
$Sb\ Bi^3$ { Sb 16·81 / Bi 83·19 }	9·095	9·277	0·182
$Sb\ Bi^4$ { Sb 13·17 / Bi 86·83 }	9·276	9·391	0·115
$Sb\ Bi^5$ { Sb 10·82 / Bi 89·18 }	9·369	9·464	0·095
Bismuth and Zinc.			
Bi Zn	9·046	9·132	0·086

Tin and Lead.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Pb\ Sn^5$ { Pb 26·03 / Sn 73·97 }	8·093	8·367	0·254
$Pb\ Sn^4$ { Pb 30·57 / Sn 69·43 }	8·196	8·548	0·352
$Pb\ Sn^3$ { Pb 36·99 / Sn 63·01 }	8·418	8·823	0·405
$Pb\ Sn^2$ { Pb 46·82 / Sn 53·18 }	8·774	9·232	0·458
$Pb\ Sn$ { Pb 63·78 / Sn 36·22 }	9·458	9·938	0·480
$Sn\ Pb^2$ { Sn 22·11 / Pb 77·89 }	10·105	10·525	0·420
$Sn\ Pb^3$ { Sn 15·91 / Pb 84·09 }	10·421	10·783	0·362
$Sn\ Pb^4$ { Sn 12·43 / Pb 87·57 }	10·587	10·927	0·340
$Sn\ Pb^5$ { Sn 10·20 / Pb 89·80 }	10·751	11·017	0·266

Lead and Antimony.

Formulæ of alloys and per centages.	Obtained.	Calculated.	Difference.
$Sb\ Pb^5$ { Sb 11·08 / Pb 88·92 }	10·556	10 919	0·363
$Sb\ Pb^4$ { Sb 13·48 / Pb 86·52 }	10·387	10·805	0 418
$Sb\ Pb^3$ { Sb 17·20 / Pb 82·80 }	10·136	10·629	0·493
$Sb\ Pb^2$ { Sb 23·68 / Pb 76·32 }	9·723	10·321	0·598
$Sb\ Pb$ { Sb 38 39 / Pb 61·61 }	8·953	9·624	0·671
$Pb\ Sb^2$ { Pb 44·53 / Sb 55·47 }	8·330	8·959	0·629
$Pb\ Sb^3$ { Pb 34 86 / Sb 65·14 }	7·830	8·355	0·525
$Pb\ Sb^4$ { Pb 28 64 / Sb 71·36 }	7·525	8·059	0·534
$Pb\ Sb^5$ { Pb 24·31 / Sb 75·69 }	7·432	7·854	0·422

These researches reveal two important facts: first, that there is one metal the alloys of which always contract, viz: those of copper, whilst all the amalgams expand or have a less specific gravity; secondly, that the maximum expansion or contraction of alloys and amalgams generally occurs in those which are composed of one equivalent of each metal, the exception being those of tin and zinc. But this arises no doubt from the fact that all the alloys, with the exception of the latter, are compounds and not mixtures.

We must, in conclusion, draw attention to the extraordinary contraction or expansion that some of these alloys experience. Thus, for example, the alloy of 3 of copper and 1 of tin:—

Found.	Calculated.	Difference.
8·954	8·208	0·746

whilst the amalgams of tin expand to nearly the same extent, as shown by these results:—

	Found.	Calculated.	Difference.
1 of Mercury, 1 of Tin,	10·255	11·259	1·004

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*On the Coating of Engraved Copper Plates by the Galvanoplastic Process.** By Dr. H. Meidinger.

The extremely remarkable application of the electrotype, which cannot fail to come into general use in the preparation of copper plates, and to diminish their cost considerably, has recently been repeated by a Frenchman of the name of Jacquin. Several years ago Prof. Böttger showed that iron could be easily separated by the galvanic current from a solution of 1 part of ammonia and 2 parts of sulphate of iron. It then presents the appearance of a silver-white speculum, and ad-

* From the Lond. Chemical Gazette, No. 406.

heres quite firmly in thin layers upon well-cleaned metallic surfaces of copper, brass, &c.; but a thicker deposit separates again readily on bending. This perfectly pure iron precipitated by galvanism possesses quite different physical properties from that obtained by the process of smelting, which always contains intermixtures, although often in small quantities, of foreign bodies, especially carbon; that obtained by galvanism is as hard as steel and as brittle as glass. Upon this property depends Jacquin's discovery, which is, at the same time, the first technical application of iron deposited by galvanism.

Engravings on copper are well known to lose greatly in sharpness and expression after the first few hundred impressions have been worked off (these are consequently more highly prized and command a far better price in the market). This falling off of the plates is due to the constant friction and the great pressure to which they are exposed, by which the surface of the plate is gradually rubbed away, and the engraving becomes lighter until it may even disappear entirely.

The electrotype has indeed already enabled us to make any number of identical copies of an engraved copper plate; the process is, however, uncertain in unpractised hands and rather expensive; and, moreover, an electrotype copy of a copper plate will only furnish a far smaller quantity of fine impressions than the original plate of hammered copper, as its surface is much more easily worn away. For this reason there is no doubt that Jacquin's method of treating the surface of the original plate itself in so simple, certain, and cheap a way, to enable it to furnish an almost unlimited number of equally good impressions, must be exceedingly welcome to all copper-plate engravers. This process consists, in brief, in coating the plate when completed with a very thin layer of galvanoplastic iron. In consequence of its extraordinary hardness, the latter undoubtedly resists wear much better than the soft copper; and even should it suffer in the course of working, or become detached in spots, there is nothing to prevent the rest of the iron from being removed entirely by means of dilute sulphuric acid without the least injury to the copper plate, which may then be furnished with a new coating in the galvanic bath.

In order that the operation may be successful, some precautions must be observed. As in all cases where a galvanic deposit is to adhere firmly to a metallic ground (as in gilding and plating, coppering zinc and iron, &c.), a perfectly clean surface must be offered to the deposit of iron; the engraved copper plate must not be in the least greasy or oxidized. The grease which may be produced upon it by mere contact with the fingers, is best removed by means of a little solution of caustic alkali; a solution of carbonate of soda may also fulfil the object. To remove oxide, the plate is immersed in dilute sulphuric acid, so that at last it appears perfectly bright. It is then washed with water, and put immediately into the iron-bath. Here it is attached to the negative pole by means of a copper wire, and opposite to it, at a uniform distance of half an inch to one inch, is placed a plate of iron of the same size united with the positive pole. By means

of a powerful battery (which, however, must never give rise to the formation of bubbles of hydrogen on the copper plate), a perfectly uniform coating of bright iron is obtained in a short time, from 5 minutes to a quarter of an hour. The prepared plate is then very quickly washed with pure water, and afterwards with a solution of carbonate of soda, dried with a fine cloth, and finally rubbed with a little oil or some other fatty matter in order to prevent any injurious effects of air and moisture; in fact, the plate is now treated just like an engraved steel plate, which it exactly resembles. The excess of ink is said to rub off the surface of the iron much more readily than off copper, so that the work of the printer is shortened by about half the time, in other words, twice as many impressions may be obtained in the same time. If this prove true, it forms a further and very valuable advantage of the new process.

As regards the composition of the saline bath, the author still considers the method described by Böttger as the best. The preparation of the bath by Jacquin's method, by means of the electrical current itself, by dissolving an iron plate connected with the positive pole in the solution of muriate of ammonia, is tedious, expensive, and inadmissible even upon theoretical grounds. The bath is, therefore, made with 2 parts of commercial sulphate of iron and 1 part of muriate of ammonia, which are mixed together and treated with water until the whole is dissolved; 2 pounds of sulphate of iron and 1 pound of muriate of ammonia require about 4 litres of water, when the solution amounts to not quite 5 litres. If the solution is to be employed directly, it must be previously boiled with fragments of iron plate (or nails), in order to convert any peroxide of iron that may be contained in the sulphate into protoxide, as the former would injure the deposit of iron. The same end is attained by leaving the solution for several days in contact with metallic iron in closed vessels. It is also necessary after use to preserve the solution in such a way that it may not readily combine with oxygen. The sign of its goodness is its pale green color; it must on no account possess any yellowish tinge. The formation of yellowish-brown or even black flakes in the solution during the operation cannot be entirely prevented; they are separated by filtration when convenient, but have no unfavorable influence upon the formation of the deposit of iron, if the copper plate be moved slowly to and fro in the bath.

The best form of cell for the decomposition is a wooden trough, of the length and depth of the copper plate, and about 2 inches clear in width; it should be coated internally with wax or pitch. If the iron plate which serves as the positive pole, and which dissolves during the operation in the same proportion that the iron is deposited upon the copper plate, and thus keeps the bath in a proper state, be fixed to one wall of the trough, it leaves sufficient space to allow the copper plate to be slightly vibrated. Such an arrangement is to be preferred in this case to the employment of a flat trough, which is advantageously used in the preparation of thick copper plates.

Daniell's battery produces a sufficiently strong current for the de-

composition of the solution of iron, if the negative excitant (the copper cylinder surrounding the zinc) possesses about the same amount of surface as the engraved copper plate. If the latter be very large, two or three Daniell's elements may be employed.—*Dingler's Polytechn. Journal*, clii. p. 359.

On the Resistance of Glass Globes and Cylinders to collapse from external pressure, and on the Tensile and Compressive Strength of various kinds of Glass. By WILLIAM FAIRBAIRN, Esq., C. E., F. R. S., and T. TATE, Esq., F. R. A. S.—Received May 3, 1859.

[From the Proceedings of the Royal Society, No. 35.]

The researches contained in this paper are in continuation of those upon the Resistance of Wrought Iron Tubes to collapse, which have been published in the "Philosophical Transactions" for 1858.* The results arrived at in those experiments were so important as to suggest further inquiry under the same conditions of rupture with other materials; and glass was selected, not only as differing widely in its physical properties from wrought iron, and hence well fitted to extend our knowledge of the laws of collapse, but because our acquaintance with its strength in the various forms in which it is employed in the arts and in scientific research is very limited. To arrive at satisfactory conclusions, the experiments on this material were extended so as to embrace the direct tenacity, the resistance to compression, and the resistance to bursting, as well as the resistance to collapse.

The glass experimented upon was of three kinds:—

	Specific gravity.
Best flint glass,	3·0782
Common green glass,	2·5284
Extra white crown glass,	2·4504

Tenacity of Glass.—For reasons detailed by the authors, the experiments upon the direct tenacity of glass made by tearing specimens asunder are less satisfactory than those in the rest of the paper; and it is argued that more reliance is to be placed upon the tenacity deduced from the experiments on the resistance of globes to bursting in which water-pressure was employed, than upon the tenacity obtained directly by tearing specimens asunder. The results obtained by the latter method give the following mean results:—

	Tenacity per square inch in pounds.
Flint glass,	2413
Green glass,	2896
Crown glass,	2346

Resistance of Glass to Crushing.—The experiments in this section were made upon small cylinders and cubes of glass crushed between parallel steel surfaces by means of a lever. The cylinders were cut of the required length from rods drawn to the required diameter, when molten, and then annealed, in this way retaining the exterior and first cooled skin of glass. The cubes were cut from much larger portions,

* See Journ. Frank. Inst., present series, vol. xxxvi, pp. 145 and 227.

and were in consequence probably in a less perfect condition as regards annealing. Hence, as might have been anticipated, the results upon the two classes of specimens, although consistent in each case, differ widely from one another.

The mean compressive resistance of the cylinders, varying in height from 1 to 2 inches, and about 0·75 inch in diameter, is given in the following Table:—

Description of glass.	Height of cylinder in inches.	Mean crushing weight per square inch.		Mean crushing weight per square inch.	
		in pounds.	in tons.	in pounds.	in tons.
Flint glass, . .	1·0	29,168	13·021	27,582	12·313
	1·5	20,775	9·274		
	2·0	32,803	14·644		
Green glass, . .	1·0	22,583	10·081	31,876	14·227
	1·5	35,029	15·628		
	2·0	38,105	16·974		
Crown glass, .	1·0	23,181	10·348	31,003	13·840
	1·5	38,825	17·332		

The specimens were crushed almost to powder by the violence of the concusssion; it appeared, however, that the fracture occurred in vertical planes, splitting up the specimen in all directions. Cracks were noticed to form some time before the specimen finally gave way; then these rapidly increased in number, splitting the glass into innumerable prisms, which finally bent or broke, and the specimen was destroyed.

The following Table gives the results of the experiments upon the cut cubes of glass:—

	Mean resistance to crushing	
	in pounds.	in tons.
Flint glass, . .	13,130	6·861
Green glass, .	20,206	9·010
Crown glass, .	21,867	9·762

Hence, comparing the results on cylinders with those on cubes, we find a mean superiority in the former case in the ratio of 1·61 : 1, due to the more perfect annealing of the glass.

On the Resistance of Glass Globes to Internal Pressure.—In these experiments the tenacity of glass is obtained by a method free from the objections to that before detailed. Glass globes, easily obtained of the requisite sizes, in a nearly spherical form, were subjected to an internal pressure obtained by means of a hydraulic pump, uniformly and steadily increased till the globe gave way. The lines of fracture radiated in every direction from the weakest part, passing round the globe as meridians of longitude and splitting it up into thin bands, varying from $\frac{1}{20}$th to $\frac{1}{8}$th of an inch in breadth.

The following Table gives the results of the experiments on the resistance of glass globes to internal pressure:—

Description of glass.	Diameters.	Thickness.	Bursting pressure per square inch.
	Inches.	Inches.	Pounds.
Flint glass, .	4·0×3·98	0·024	84
	4·0×3·98	0·025	93
	4·0	0·038	150
	4·5×4·55	0·056	280
	5·1×5·12	0·058	184
	6·0	0·059	152
Green glass, .	4·95×5·00	0·022	90
	4·95×5·00	0·020	85
	4·00×4·05	0·018	84
	4·00×4·03	0·016	82
Crown glass, .	4·2 ×4·35	0·025	120
	4·05×4·2	0·021	126
	5·9 ×5·8	0·016	69
	6·0 ×6·3	0·020	86

The formula which expresses the relation of the bursting pressure to the thickness and diameter of the globe, is—

$$P = \frac{a}{A} T;$$

where a = the longitudinal sectional area of the material in square inches, that is in the line of rupture or line of minimum strength; A = the longitudinal sectional area of the globe in square inches; and T = the tenacity of the glass in pounds per square inch. Hence, from the above experiments we deduce—

Pounds.

T = 4200 for flint glass,
= 4800 for green glass,
= 6000 for crown glass,

5000 = mean tenacity of glass.

Here the mean tenacity is nearly twice that obtained in the experiments upon thick bars; a result, which perhaps corresponds with the difference between the crushing strength of cylinders and cubes, and is largely attributable to the condition of annealing.

On the Resistance of Glass Globes and Cylinders to an External Pressure.—The manner of conducting these experiments did not differ in any essential detail from that pursued in the experiments upon wrought iron. The globes and cylinders, after having been hermetically sealed in the blow-pipe flame, were fixed in a wrought iron boiler communicating with a hydraulic pump. In this position an increasing pressure was applied until the globes broke, the amount of pressure at the time being noted by means of a Schäffer pressure gauge. During the collapse the tubes were reduced to the smallest fragments, so that no indication of the direction of the primary lines of fracture could be discovered.

The following Table contains a summary of the results on glass globes subjected to an external pressure:—

Description of glass.	Diameters.	Thickness.	Collapsing pressure per square inch.
	Inches.	Inches.	Pounds.
Flint Glass, .	5·05×4·76	0·014	292
	5·08×4·7	0·018	410
	4·95×4·72	0·022	470
	5·6	0·020	475
	8·22×7·45	0·010	35
	8·2 ×7·2	0·012	42
	8·2 ×7·4	0·015	60
	4·0 ×3·98	0·024	(900*)
	4·0	0·025	(900*)
	6·0	0·059	(1000*)
Green glass, . .	5·0 ×5·02	0·0125	212

* These globes remained unbroken.

The following Table contains a similar summary of the results upon cylindrical vessels:—

Description of glass.	Diameters.	Length.	Thickness.	Collapsing pressure per square inch.
	Inches.	Inches.	Inches.	Pounds.
Flint glass, .	3·09	14·0	0·024	84
	3·08	14·0	0·032	103
	3·24	14·0	0·042	175
	4·05	7·0	0·034	202
	4·05	7·0	0·046	380
	4·06	13·8	0·043	180
	4·02	13·8	0·064	297
	3·98	14·0	0·076	382
	4·05	7·0	0·079	(500†)

† Remained unbroken.

The paper includes an investigation of the laws of collapse as exhibited in these results, and the following general formulæ are obtained:

For glass globes, . . $P = 28{,}300{,}000 \times \frac{k^{1\cdot4}}{D^{3\cdot4}}$,

For glass cylinders, . . $P = 740{,}000 \times \frac{k^{1\cdot4}}{D\,L}$,

where P = the collapsing pressure in pounds per square inch; k = thickness in inches; D and L = diameter and length respectively in inches.

These are the general formulæ for glass vessels subjected to an external pressure, and the latter is precisely similar to that found for sheet iron cylinders.

Transverse Strength of Glass.—The authors derive the general formula

$$W = 3140 \times \frac{K.D}{l},$$

where W = breaking weight in pounds, K = area of transverse section, D = depth of section, l = length between supports;—to express the transverse strength of a rectangular bar of glass supported at the ends and loaded at the middle.

*Tinned Lead Tubes.**

The authorities of Paris have prohibited the employment of lead for tubes intended to convey beer or water for drinking purposes. M. Sébille, of Nantes, has invented an ingenious process for tinning lead tubes inside or out, or both, which, from the specimens exhibited, appears eminently successful, and which has the merit of cheapening the article, by reason of the superior resisting power of the tin permitting the diminution of the leaden tube by about one-tenth of the ordinary thickness of metal. Tinned lead tubes have been found to possess sufficient rigidity to allow of their being worked and bent without bulging inwards and flattening. Taking 500 metres of ordinary lead tubing, mixed gauges, the weight will be 2460 kilos.; and at 70 francs the 10 kilos., the cost will be 1722 francs. Five hundred metres of the new tinned lead tubing, by reason of the reduction in the thickness of metal, will weigh 2214 kilos., which, at 76 francs the hundred kilos., will make the cost 1682 francs, or 39 francs less for a less destructible and stronger article. The machinery and process of manufacture are as follows:—The molten lead is run by a side opening into a cast iron vertical cylinder situated above the piston of an hydraulic press. The cylinder is closed at top by a cover having an opening of the diameter required, and in the centre of which is placed a mandril or core. The lead is allowed to solidify, that is to say, to fall to a temperature of from 482° to 518° Fah., at which it is kept by heat applied to the outside of the cylinder. When this temperature is reached, the hydraulic press is set working, and the lead expelled through the annular opening in the cover; the mandril in the centre of the opening is provided on its circumference with four knives, which scrape the interior surfaces of the lead. On leaving the annular opening, the lead comes into contact with molten tin, which penetrates into its pores, and is firmly attached to its whole surface. As tin melts at 446° Fah., the lead possesses sufficient heat to keep the tin always fluid. A ring on the exterior or sphere in the interior of the tube, fixed where it leaves the machine, regulates the thickness of the tin coating and smoothes its surface. The reason, it may be remarked, of the tin attaching itself to the lead without the previous use of a mordant is, that the knives clean the surface which comes in contact with the tin before it can be acted upon by the atmosphere. The gas and water companies in the French towns use M. Sébille's tinned lead tubes to the exclusion of all others, on account of their economical and sanitary advantages.

Condensed Abstract of a first set of Experiments, by Messrs. Robert Napier and Sons, on the strength of Wrought Iron and Steel.† By W. J. Macquorn Rankine, C.E., LL.D., F.R.S.

The experiments to which this abstract relates form the first set of a long series now in progress by Messrs. Robert Napier and Sons; the details being conducted by their assistant, Mr. Kirkcaldy. The whole

* From the London Civ. Eng. and Arch. Jour., Oct., 1859. † Ibid.

results are now in the course of being printed *in extenso* for publication in the Transactions of the Institution of Engineers in Scotland; but some time must elapse before they can appear, owing to the great volume of the tables and the number of particulars which they give.

The present abstract is all that it has been found practicable to prepare in time for the meeting of the British Association; and notwithstanding its brevity and extreme condensation, it is believed that the results which it shows will be found of interest and importance. It gives the tenacity, and the ultimate extension when on the point of being torn asunder, of the *strongest* and the *weakest* kinds of iron and steel from each of the districts mentioned. Each result is the mean of four experiments at least, and sometimes of many more. The detailed tables, now being printed, will show many more particulars; and especially the contraction of the bars in transverse area along their length generally, owing to the "drawing out," and the still greater contraction at the point of fracture. The experiments now complete were all made with loads applied gradually. Experiments on the effect of suddenly applied loads are in progress.

TABLE A. *Iron Bars.*

	Tenacity in lbs. per sq. in.	Ultimate extension in decimals of length.
Yorkshire, strongest	62886	0·256
" weakest	60075	0·205
" (forged)	66392	0·202
Staffordshire strongest	62231	0·222
" weakest	56715	0·225
West of Scotland, strongest	64795	0·173
" weakest	56655	0·191
Sweden, strongest	48232	0·264
" weakest	47855	0·278
Russia, strongest	56805	0 153
" weakest	49564	0·133

TABLE B. *Iron Plates.*

Yorkshire, strongest lengthwise	56005	0·141
" weakest "	52000	0·132
" strongest crosswise	50515	0·093
" weakest "	46221	0·076

Note.—The strongest lengthwise is the weakest crosswise, and *vice versa.*

TABLE C. *Steel Bars.*

Steel for tools, rivets, &c., strongest	132909	0 054
" " weakest	101151	0·108
" for other purposes, strongest	92015	0·153
" " weakest	71486	

TABLE D. *Steel Plates.*

Strongest lengthwise	94289	0·0571
Weakest "	75594	0·1982
Strongest crosswise	96308	0·0964
Weakest "	69082	0·1964

NOTE.—The strongest and weakest lengthwise are also respectively the strongest and weakest crosswise.

*White Brass.** By M. Sorel.

A metallic alloy consisting of 10 parts of copper, 10 parts cast iron, and 80 parts of zinc, may be turned, filed, and bored, does not adhere to the moulds in casting, and retains its lustre for a very long time in moist air.—*Polytechnic Centralblatt*, 1859, p. 971.

* From the Lond. Chemical Gazette, No. 411.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 15, 1859.

John Agnew, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Geographical Society, London, and E. S. Philbrick, Esq., Civ. Eng., Boston, Mass.

Donations to the Library were received from the Royal Geographical Society, and the Royal Astronomical Society, London; L. A. Huguet-Latour, Esq., Montreal, Canada; the Smithsonian Institute, Washington, D. C.; the Boston and Worcester Railroad Co., Boston, Mass.; the Virginia and Tennessee Railroad Co., Lynchburg, Virginia; J. Smith Homans, Esq., and B. F. Isherwood, Esq., Eng. U. S. N., City of New York; the Fulton Institute, Lancaster, Penna.; A. B. Cooley, Esq., the Hibernia Fire Engine Co., No. 1., and Prof. J. F. Frazer, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of December, was read.

The Board of Managers and Standing Committees reported their minutes.

Thirty-seven resignations of membership in the Institute were read and accepted.

Candidates for membership in the Institute (9) were proposed, and the candidates proposed at the last meeting (17) were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

Resolved:—That the polls for receiving the votes of the members at the Annual election for Officers, Managers, and Auditors for the ensuing year, to be held on the third Thursday of January next, be opened at 3½ o'clock P. M., and closed at 8 o'clock P. M.; and that seven members be appointed by the President to receive the votes and report the results thereof.

R. Martin sent, through the Committee on Meetings, a sample of his patent metallic steam packing. It consists of a ribbon of woven hemp, rolled up into the form of a ring, whose inner diameter is somewhat greater than the rod intended to be packed, and whose outer

diameter is sufficient to fill the stuffing-box. About one-third of the ribbon is wound up, when a strip of prepared gum, sufficient to form a complete circle, is wound in with the coil; then, a strip of wire gauze is placed in the hole, and sewed, at its lower edge, with brass wire to the hemp; when the top edge is snipped at intervals, turned over the flat part, and the then outer corner of the coil, when the winding is resumed, and the gum enveloped by the hemp; which, when all wound has its end sewed to the body. Several of these rings are put into each stuffing-box, and they may, if required, be cut through in order to get them around the rod, though it is preferable to keep them entire. The gland need not be screwed down with a wrench, there being sufficient power in the fingers. It is claimed that the following advantages belong to this packing:—1st, A clear gain of power from reduced friction. 2d, It will not groove the sliding surface, but keep it perfectly smooth and bright. 3d, Durability, and consequent economy. That put in use has shown it to be entitled to the first and second claim; but, the length of time it has been in operation will not warrant an opinion upon the merit of the third claim.

Mr. A. F. Porter, the manufacturer, No. 420 Walnut Sreet, Philadelphia, has put it in use upon several engines in this City, and with uniform good results.

A spirit level for horizontal, inclined, and vertical operations, was exhibited by the Committee on Meetings. It consists of the usual tubes set into a brass piece of semicircular shape, which is contained in the block or main piece, also of brass. The block on the bottom part is shaped like a swallow's tail, with a flattening of the point, to give more bearing surface. The semicircular piece moves around a centre, and has its periphery graduated so that any number of degrees may be set. The use of the swallow-tail shape is, to obtain vertical points on a shaft by placing it astride, and striking a vertically sliding centre punch when the bubble indicates horizontality. This gives the starting points for key seats of cranks, when intended to be either in the same plane, or any required angle with each other. The instrument is nicely fitted, and will, no doubt, prove useful.

Mr. Robert Street exhibited his patent Fluid Gas Lamp. The body of this lamp is of the usual construction, but having a pipe leading from the bottom of the globe containing the fluid to the burner; within this pipe the wick is placed, which reaches to the bottom of the burner; the fluid is admitted to the wick by a stop-cock which regulates the flow. Attached to the burner is a mass of metal, which being heated converts the fluid into a gas and thus passes through the burner and furnishes the light.

Mr. Thomas E. McNeill exhibited and explained a model of his improved Sleeping Car for Railroad.

Mr. S. W. Hoffman showed to the meeting a model of his improvement in oiling the axles of railway cars and other carriages, and explained its mode of operation.

Detailed descriptions of Mr. McNeill's and Mr. Hoffman's patent, will be published in a future number of the Journal.

Abstract of Meteorological Observations for October, 1859; made in Philadelphia, Adams, and Somerset Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

GETTYSBURG, Adams Co. Lat. 39° 49′ N. Long. 77° 18′ W. Height 624 feet. Prof. M. JACOBS, Obs.

SOMERSET, Somerset Co. Lat. 40° N. Long 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.

1859. Oct.	Philadelphia. Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain and Snow.	Prevail'g winds.	Gettysburg. Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Rain and Snow.	Prevail'g winds.	Somerset. Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain and Snow.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Inch.	Per ct.	Inches.	Direc.	Inch.	Inch.	°	°	Inch.	Direc.	Inch.	Inch.	°	°	Inch.	Per ct.	Inch.	Direc.
1	29·987	·144	65·2	22	3·0	·448	56		(var.)	29·607	·168	63·3	1·7	0·009	S S W.	27·738		57·3	2·0	·497	83	0·037	W.
2	29·835	·152	64·0	19	5·2	·384	52		W.	29·476	·131	61·0	3·0		S W.	27·690		54·3	4·3	·395	54		W.
☽ 3	29·952	·117	62·0	20	3·3	·278	37		S W.	29·596	·121	56·0	5·0		S W.	27·753		55·3	5·0	·448	61		W.
4	29·913	·039	66·3	29	5·0	·536	54		S W.	29·535	·062	54·7	4·7		S.	27·740		59·7	4·3	·567	67		
5	29·738	·175	68·0	25½	2·3	·486	47		N W.	29·389	·146	62·0	7·3		(var.)	27·658		58·7	4·3	·396	51		
6	29·853	·164	58·0	15	10·0	·215	35		N W	29·525	·138	54·3	7·7		(var.)	27·723		49·3	10·7	·262	59		N W.
7	29·941	·119	56·0	23½	3·7	·243	39		S W	29·530	·066	51·0	6·0		S	27·678	·093	48·3	7·0	·300	48		S W.
8	29·740	·231	66·7	25	10·7	·554	64	0·937	S W	29·279	·251	62·3	11·3	0·145	S W.	27·494	·184	54·7	8·3	·429	77	0·058	(var.)
9	29·780	·086	51·6	14	15·0	·321	80	0·024	N E.	29·350	·071	50·8	11·5		N E.	27·651	·157	40·0	8·7	·232	60		N.
10	29·924	·143	49·7	16	4·7	·242	52	1·370	(var.	29·579	·229	49·8	8·0		N.	27·704	·114	42·3	7·0	·236	54		N W.
○ 11	29·989	·065	56·7	25½	7·0	·332	50		N W.	29·679	·099	56·0	6·8		W.	27·829	·065	49·0	6·7	·345	54		W.
12	30·051	·062	59·0	21	2·3	·366	52		N E.	29·671	·022	56·3	2·3		S E.	27·829	·023	55·3	0·3	403	53		S W.
13	29·933	·118	61·5	21	2·5	·416	57		S.	29·548	·123	57·7	2·7		S W.	27·749	·086	57·3	2·7	·416	57		W.
14	29·738	·195	66·2	21	4·7	·540	60		S W.	29·401	·163	61·7	4·0		W.	27·611	·138	56·7	7·3	·458	75	0·054	(var.)
15	29·884	·145	53·2	17	13·0	·189	38		N W.	29·487	·094	50·5	8·2		var.	27·749	·138	41·7	11·7	·231	83		N W.
16	30·183	·299	48·7	17	4·5	·210	48		S E.	29·815	·329	50·0	4·2		?	27·896	·147	44·0	10·3	·236	54		S E.
17	30·036	·147	55·5	20	6·8	·355	62	0·276	S.	29·662	·153	57·0	7·0		S W.	27·703	·179	53·0	9·7	·404	93	0·219	S.
18	29·668	·369	57·8	17	9·0	·311	56	0·084	(var.)	29·343	·319	42·0	15·0	0·106	var.	27·533	·179	47·3	11·0	·212	63	0·430	W.
☾ 19	29·740	·103	47·3	14½	10·5	·146	36		N W.	29·361	·135	49·8	8·5		W.	27·564	·141	42·0	7·3	·188	56		N W.
20	29·693	·098	41·2	16	7·5	·159	53		N W.	29·234	·127	43·3	6·5		W.	27·534	·135	36·3	8·3	·129	61		N W
21	29·752	·063	38·2	14½	4·7	·095	23		N W.	29·379	·145	40·3	3·7		W.	27·621	·094	33·0	4·7	·103	45		N W.
22	29·784	·032	39·7	18	1·8	182	61		S W.	29·366	·062	37·0	3·7	0·056	.	27·474	·147	34·3	3·3	·178	81	0·136	?
23	29·907	·157	45·2	14	5·5	·183	47		N W.	29·495	193	45·3	8·3		.	27·722	·248	38·0	7·0	·211	72	0·021	N W.
24	29·936	·111	48·0	22	3·5	·242	52		W.	29·581	·213	45·7	1·0			27·702	·085	43·7	11·0	·288	61		S.
● 25	29·586	·350	54·8	20	6·8	·284	48		W.	29·236	·345	56·5	7·2			27·427	·278	48·0	5·0	·288	61		N W.
26	29·605	·059	36·7	10	18·2	·100	42	0·293	N W.	29·201	·101	38·7	14·5	0·300	N E.	27·280	·146	37·3	10·7	·177	66	0·200	S E.
27	29·529	·114	35·8	11	3·5	·130	55		N N W.	29·142	·157	38·7	5·3		(var.)	27·338	·159	32·0	5·3	·121	59		W.
28	29·693	·165	39·8	20	4·0	·146	47		N W.	29·327	·183	41·7	2·0		(var.)	27·491	·153	33·3	1·3	·116	53		W.
29	29·829	·136	42·0	11	2·8	·159	53		N W.	29·478	·157	38·3	2·3		N W	27· 0	·169	37·7	4·3	·073	24		W N W
30	30·015	·186	43·6	9	1·7	·129	40		N W.	29·708	·227	40·0	3·0		N W.	27·805	·143	35·0	3·3	·165	72		W.
31	0·024	·013	43·7	13	1·3	·142	42		N W.	29·696	·024	37·7	3·0		N W.	27·808	·040	34·0	1·0	·143	66		W N W
Means	29·845	·140	52·3	18	5·9	·274	50	3·210	N 75½ W.	29·473	·154	50·0	6·0	0·616	N 88½ W.	27·052	·124	45·7	6·4	·276	62	1·155	N 74½ W